TRS-80®

DMP-420
Operation Manual
Catalog Number 26-1267

SERVICE POLICY

Radio Shack's nationwide network of service facilities provides quick, convenient, and reliable repair services for all of its computer products, in most instances. Warranty service will be performed in accordance with Radio Shack's Limited Warranty. Non-warranty service will be provided at reasonable parts and labor costs.

Because of the sensitivity of computer equipment, and the problems which can result from improper servicing, the following limitations also apply to the services offered by Radio Shack:

1. If any of the warranty seals on any Radio Shack computer products are broken, Radio Shack reserves the right to refuse to service the equipment or to void any remaining warranty on the equipment.

2. If any Radio Shack computer equipment has been modified so that it is not within manufacturer's specifications, including, but not limited to, the installation of any non-Radio Shack parts, components, or replacement boards, then Radio Shack reserves the right to refuse to service the equipment, void any remaining warranty, remove and replace any non-Radio Shack part found in the equipment, and perform whatever modifications are necessary to return the equipment to original factory manufacturer's specifications.

3. The cost for the labor and parts required to return the Radio Shack computer equipment to original manufacturer's specifications will be charged to the customer in addition to the normal repair charge.

TANDY
COMPUTER
PRODUCTS

PARALLEL PRINTER CABLE
Tandy 1200 and IBM* "PC"
To Designated Radio Shack Printers

System compatibility requires the proper matching of three essential elements: cable, printer and computer application software.

1. Cable: Cat. No. 26-1347B and 26-1371 provide the correct "parallel" electrical/mechanical interface between an IBM PC or "PC clone" (such as the Tandy 1200) and most Radio Shack printers, as defined by Centronics standard protocol. It does *not* assure the additional control and character code (software) compatibility required between the computer application and the printer.

2. Printer: The Carriage Return control code causes a Radio Shack printer both to return the print head to the home position and to advance the paper by one line. In "IBM compatible printers" the print head returns home, but a separate line feed code must be sent to advance the paper. Dip switches are available on most Radio Shack printers to defeat the automatic line feed originating under the Radio Shack protocol:

RADIO SHACK PRINTER	CAT. NO.	IBM LINE FEED MODE
DMP-120	26-1255	Set dip switch 1 to ON
DMP-200	26-1254	Set dip switch 1 to ON
DMP-400	26-1251	Set dip switch 6 to ON
DMP-420	26-1267	Set dip switch 6 to ON
DMP-430	26-1277	Set dip switch A-2 to ON
DMP-500	26-1252	Set dip switch 6 to ON
DMP-2100	26-1256	Set dip switch 6 to ON
LMP-2150	26-1272	Set dip switch 3 to ON
CGP-115	26-1192	Set dip switch 3 to OFF (left)
TRP-100	26-1275	Set dip switch A-2 to ON

[Note: Consult owner's manual for printer for further details concerning dip switch location, settings and code execution. If dip switch position changes are made with power ON, it will be necessary to switch the power OFF then back ON so that the printer will accept the new switch setting.]

For most Radio Shack daisy wheel printers there are no dip switches to suppress the double line feeds. However, the proper code response can be set by software command:

Daisy Wheel II (Before Serial #13010463) No software correction available

Daisy Wheel II (After Serial #13010463)

	26-1158	In BASIC, type
Daisy Wheel IIB	26-1158B	*LPRINT CHR$(27); CHR$(21);*
DWP-210	26-1257	and press Enter
DWP-410	26-1250	

DWP-510   26-1270   Set CR switch to "CR ONLY" position.

3. Computer Software Applications:

For dot matrix printers there is no single "IBM standard," but Radio Shack has selected the *IBM GRAPHICS PRINTER* as its reference. Our newest dot matrix printers (the DMP-2100P, DMP-430 and TRP-100) have a built-in IBM mode setting allowing them to respond properly to IBM MS-DOS software applications with printer drivers for the IBM Graphics Printer.

Earlier Radio Shack dot matrix printers will not run under IBM software that does not offer specific Radio Shack printer drivers. While the standard ASCII character set will probably print properly, other printer commands for line feeds, font changes, graphics and special instructions will result in printing errors.

The issue is somewhat more complex for daisy wheel printers since IBM itself did not offer one until recently to thereby establish a "standard." Typically, "IBM software" will support a variety of non-IBM printers. If the software offers the appropriate Radio Shack driver, then there should be functional compatibility. Otherwise, the printer is probably "not supported."

Looking toward compatibility for printers already in the field, several "software printer filters" are under development. These will allow conversion of IBM output codes from software (IBM Graphics Printer for dot matrix and Diablo 630 for daisy wheel) to the appropriate Radio Shack dot matrix or daisy wheel format. With these filters, any IBM/MS-DOS software that supports the IBM Graphics Printer or the Diablo 630 should be compatible with most Radio Shack printers. Ask your local Radio Shack Computer Center for availability and details.

*IBM is a registered trademark of International Business Machines Corp.

Contents

Introduction

Congratulations for selecting this Radio Shack computer product! The DMP-420 is a high-density dot-matrix printer which can perform a variety of different printing operations. For instance, it can print:

- Proportional spaced characters.
- Monospaced characters (Normal, Condensed and Compressed).
- Correspondence Quality characters.
- Graphics characters.

For maximum efficiency, the DMP-420 operates in three modes:

- Data Processing Mode for fastest output of program listings or data.
- Word Processing Mode for letter-writing or the creation of any text documentation.
- Graphics Mode for drawing pictures, figures, or graphs.

For word processing, you'll find the DMP-420's Proportional spaced characters (created on a variable 9 x 15 dot-matrix) can produce letter-quality results.

If, however, you need a printout that is produced faster, Monospaced characters (created on an 8 x 9 dot-matrix) are just the thing for you!

In Graphics Mode, you can use graphic data to draw just about any type of graphic configuration you desire.

You can use two types of paper with the DMP-420:

- Standard (4"-15" wide) computer fanfold forms with guide holes. The Printer can also print one original and up to two carbon copies.
- Standard single-sheet typewriter paper for use as an ordinary typewriter.

Other software-controlled features include:

- Bidirectional minimum-distance access carriage motion.
- Full- or Half-Line Forward and Reverse (for printing above to below the "current" line) and 3/4 Line Feed.
- Underline capability.

and much more!

1/Description of the DMP-420

Carefully remove the printer from the carton. Remove all the protector boards. Cut the clip band that keeps the tractor unit in place and untie the tie band which holds the paper bail. We recommend that you keep all packing materials, so you can pack it carefully for safe transit or shipping (should it be required).

Card Board

Cover Supporting Board

Cover and Head Print Supporting Board

Crip Band
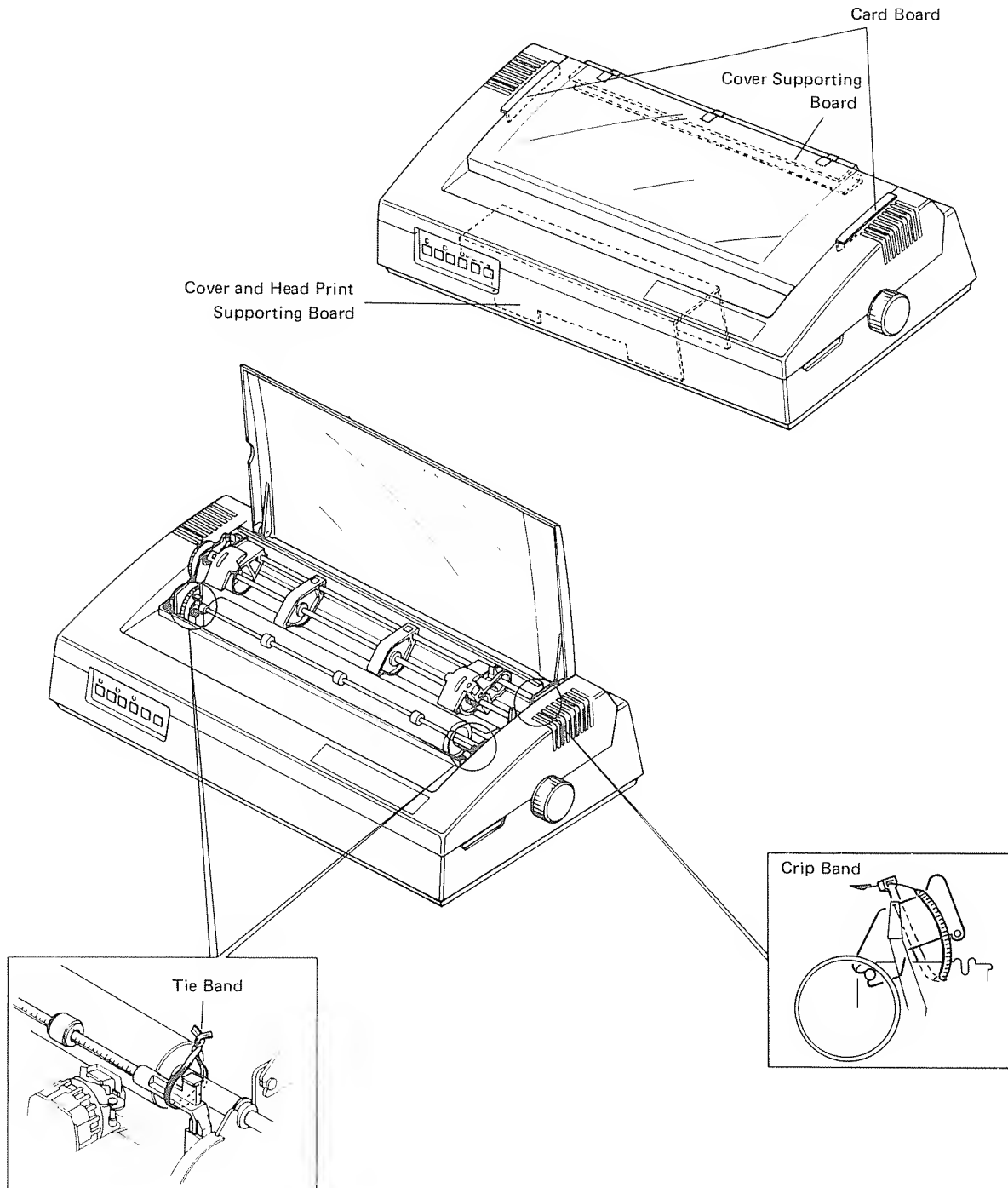
Tie Band

Figure 1. Removing the Protective Packing and Tie band

Note: Be sure to remove the packings attached. Thoroughly read this operation manual to familiarize yourself with the unit before operation.
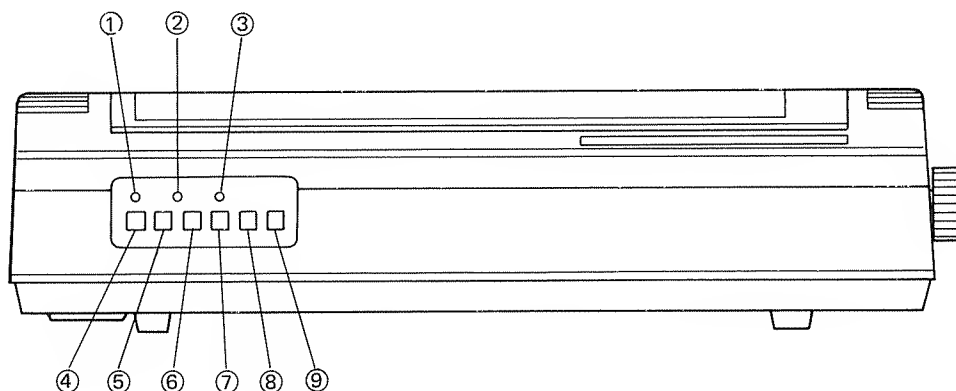
Figure 2. DMP-420 (Front View)

① **READY Indicator.** When this indicator is ON, the DMP-420 is ON-LINE and ready to print.

② **POWER ON Indicator.** This indicator will illuminate when the DMP-420 is properly connected and the Power ON/OFF Switch is set to ON.

③ **ALERT Indicator.** This indicator will come on when the Printer is out of paper, when there is a carriage fault, or when there is some sort of electrical problem.

④ **ONLINE/OFFLINE Switch.** When this switch is pressed in, the Printer is placed ON-LINE. When it is pressed again and released, the Printer is placed OFF-LINE.

⑤ **FORM FEED Switch.** When this switch is pressed, the paper advances to the logical top of the next form. It is effective only when the Printer is OFF-LINE.

⑥ **LINE FEED Switch.** When this switch is pressed, the paper advances one line. When it is held down, continuous paper feed is performed. This switch will work only when the Printer is OFF-LINE.

⑦ **△ 1/12 LINE Switch.** Pressing this switch causes the paper to advance 1/72 inch (1/12 line). When the switch is held down, continuous line feed is performed. The Printer must be OFF-LINE before pressing this switch.

⑧ **▽1/12 LINE Switch.** Pressing this switch causes the paper to move backward 1/72 inch (1/12 line). When the switch is held down, continuous paper retreat is performed. Before pressing this switch, be sure the Printer is OFF-LINE.

⑨ **RESTART Switch.** When the Printer runs out of paper, press this switch. One more line will be printed. If you wish to continue printing, insert more paper and press this switch. The Printer will automatically return to the condition which prevailed before the paper-out condition occurred. It will then restart printing without loss of data in the print buffer.

Model II users: If a BASIC program stops execution because of a Printer error, typing: CONT **(ENTER)** will cause printing to resume. However, the entire contents of the print buffer will be printed, starting with the current Print Head position.
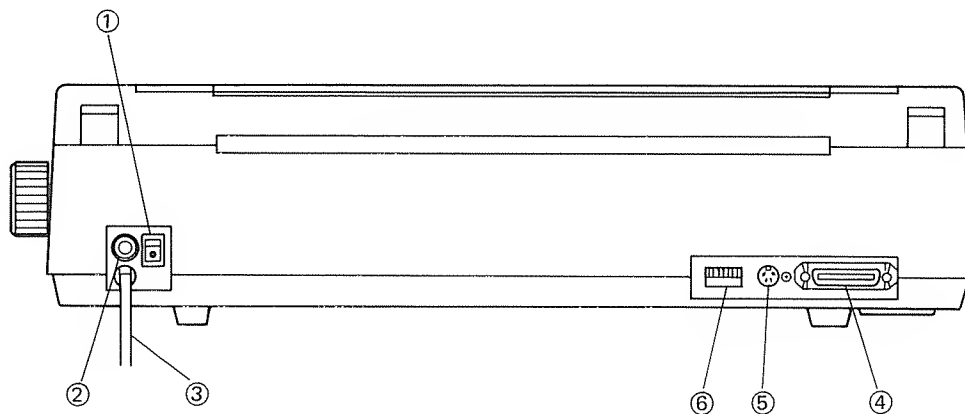
Figure 3. DMP-420 (Rear View)

① **Power ON/OFF Switch.** Press the white dot to turn the power ON. Press the Switch the other way to turn power OFF. Note that turning the power OFF and ON during operation may cause loss of the current program.

② **Fuse Holder.**

③ **Power Cord.** Plug the power cord into the wall-outlet or approved power strip.

④ **Parallel Interface Connector.** If your TRS-80 has parallel interface capabilities, connect the cable here. See **Setting Up the DMP-420** for the right cable for your TRS-80.

⑤ **Serial Interface Connector.** If your TRS-80 has serial interface capabilities, connect the cable here. See **Setting Up the DMP-420** for the right cable for your TRS-80.

⑥ **Print Function (DIP) Switches.** The settings of these Switches will determine exactly how your Printer prints in any situation. Such parameters as baud rate (600 or 1200 baud) or whether you're using the serial or parallel interface must be set via these Switches.
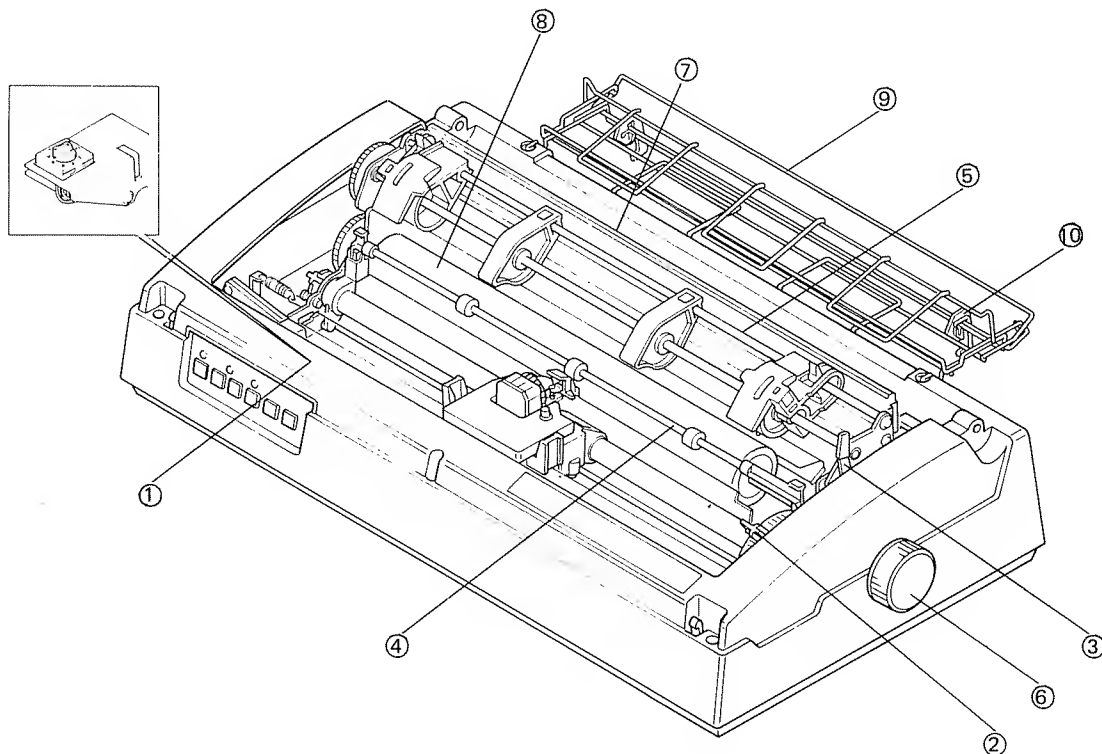
Figure 4. DMP-420 (Inside View)

① **Rotary Switch.** This Switch determines the desired character pitch when you power-up the Printer. *Set the dial with the power OFF.*

② **Print Head Control Lever.** Slide this lever to adjust the gap between the Print Head tip and the Platen print surface for optimum print quality.

  Note: When using single-sheet paper, this lever must be fully set toward the Platen.

③ **Platen Pressure Lever.** This lever has the two positions. One is "Release", for the tractor feed feature (towards the front of the Printer); the other is "Friction", for the friction feed feature (towards the rear of the Printer). The lever is used when paper is inserted through the rear opening of the DMP-420, but it has nothing to do with paper feed.

④ **Paper Bail.** For optimum print quality, keep the Bail down on the paper.

⑤ **Tractor Feed.** This Tractor Feed is removable. See **Setting Up the DMP-420** for details on using the Tractor Feed. You can remove the Tractor when printing on single-sheet paper.

⑥ **Paper Feed Knob.** Turn this knob to manually advance the paper.

⑦ **Paper Entry Slot.** Be sure the paper enters the DMP-420 here.

⑧ **Platen.**

⑨ **Paper Rack.**

⑩ **Paper Guide.**

2/Setting Up the DMP-420

This section will show you how to set up the DMP-420 so you can begin using it as quickly as possible. This includes:

- Installing the Tractor Feed.
- Loading paper.
- Replacing a ribbon.
- Connecting the DMP-420 to a TRS-80.

and more!

The following Start-Up Checklist is a summary of how to set up your Printer. You should follow this procedure *every time* you start-up the Printer — not just the first time.

☑ Find a good spot for your Printer. Be sure to consider:

- The Printer should be placed on a sturdy work surface.
- The length of the printer cable will determine how far from the TRS-80 you can place the Printer.
- Paper takes up space. Be sure to leave enough room for smooth paper flow.
- Don't place the Printer near noise generators such as refrigerators and industrial equipment.

☑ Be sure the POWER switch (on right rear side of the Printer) is OFF.

☑ Remove the packing materials.

☑ Install continuous form fanfold paper or single-sheet paper.

☑ Check the Ribbon Cassette. If it has not been installed, see **Ribbon Installation/Replacement.**

☑ Set Rotary Dial, Front Panel Switches, and Print Function (DIP) Switches (rear of Printer).

☑ Connect the AC power plug to a 3-wire, 120 volt, 60 Hz grounded AC outlet (220/240v, 50 Hz where the unit is so marked).

☑ Check to see if the Printer is ready by running the Self-Test.

☑ Connect the interface cable from the TRS-80 to the printer interface connector.

☑ Turn the Power ON and check that the Power On Indicator (on the Front Panel) is illuminated.

☑ Push the RESTART Switch.

☑ Place ON-LINE/OFF-LINE Switch in ON-LINE position.

Paper Rack Installation

1. Install the Paper Rack by inserting the tips of the Rack into holes provided on the top of the Printer (behind the Paper Insertion Opening).

2. Snap the two black plastic Paper Guides into place by "hooking" them over the top, rear bar on the Rack. Snap the bottoms of the Guides into place to lock them in. The "flat" surfaces *should be facing each other.*

   Always move the Guides to the extreme left and right sides of the bar before installing or removing.

1

2
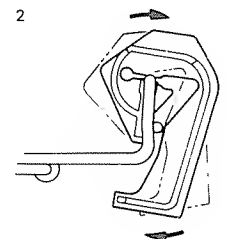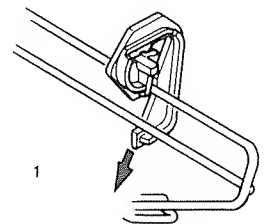
Tractor Installation and Removal

This Printer can be used with either the Tractor Feed system or the Friction Feed system. The difference is that the Tractor Feed system is used with paper which has guide holes on both edges, while the paper used with the Friction Feed system does not have these holes.

The Friction Feed system may be used with the Tractor installed; however, better operation can be achieved if it is removed — especially when using single sheets of paper.

Removing the Tractor

1. Set the ON/OFF Power Switch to OFF.

2. Open the Top Cover.

3. Move the Platen Pressure Lever forward (towards the front of Printer).

4. Hold the back bar of the Tractor (close to the edges) between the thumb and forefinger of each hand and pull upward to unlock and remove the Tractor.

5. Close the Top Cover.

Installing the Tractor

1. Set the ON/OFF Power Switch to OFF.

2. Open the Top Cover.

3. Place the front cutouts in the Tractor unit onto the outside studs (see Figure 5). Then press on the rear of the Tractor until the back posts snap into place.

4. Close the Top Cover.
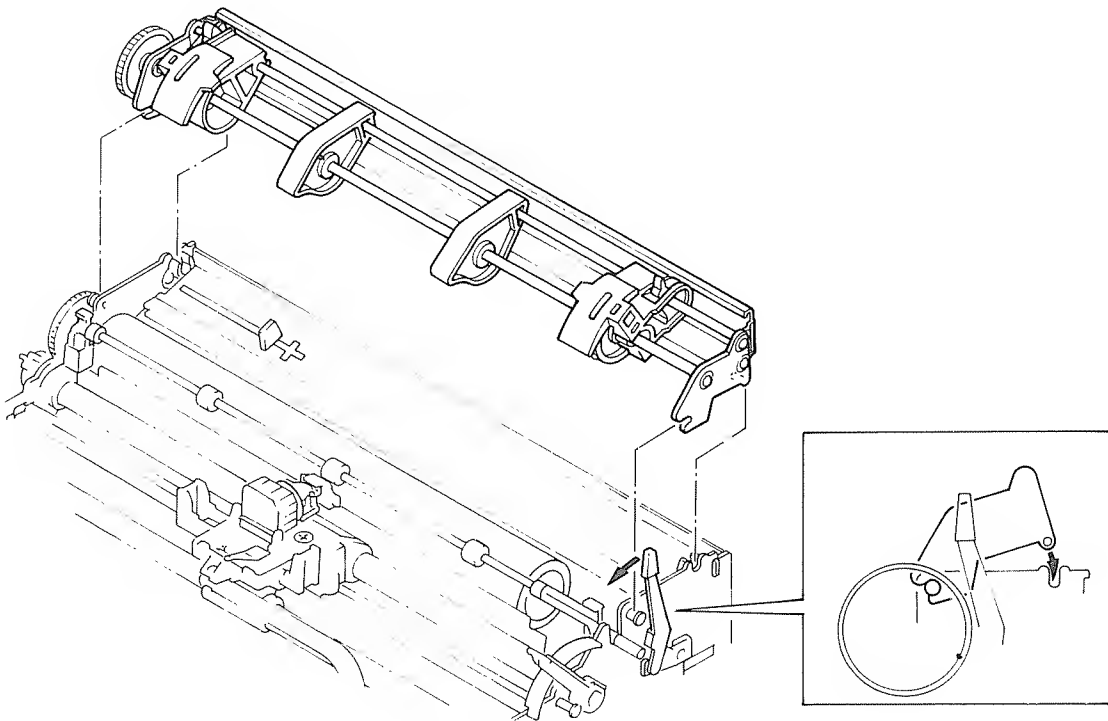
Figure 5. Installing the Tractor

8

How Does the DMP-420 Handle Paper?

The DMP-420 provides both Tractor Feed for continuous forms and Friction Feed for single-sheet printing. The Printer is supplied with the Tractor unit installed. Both Tractor Feed and Friction Feed paper can be used with the Tractor installed, but Friction Feed operation is much easier without the Tractor.

For single-sheet paper operation, first remove the Tractor as follows:

1. Set the Power Switch to OFF and Open the Top Cover.

2. Holding the Tractor on both ends, pull up on the rear of the Tractor to disengage it from the Printer.

3. Close the Top Cover.

For fanfold paper operation replace the Tractor as follows:

1. Set the Power Switch to OFF and open the Top Cover.

2. Place the claw slots (on the lower front sides of the Tractor) onto the outside studs.

3. Rock the Tractor unit back until it snaps into place.

4. Turn the Paper Feed Knob to verify that the sprockets rotate.

5. Close the Top Cover.

Paper Loading

Warning! When loading paper (single-sheet or fanfold), be sure the paper correctly enters the Paper Insertion Opening.

It is very important that the paper enter the DMP-420 straight. The paper must be directly behind the Printer or paper skewing or jamming may occur. Proper positioning of the Paper Guides (which attach to the paper rack) is important to help prevent paper jamming.

WRONG   RIGHT
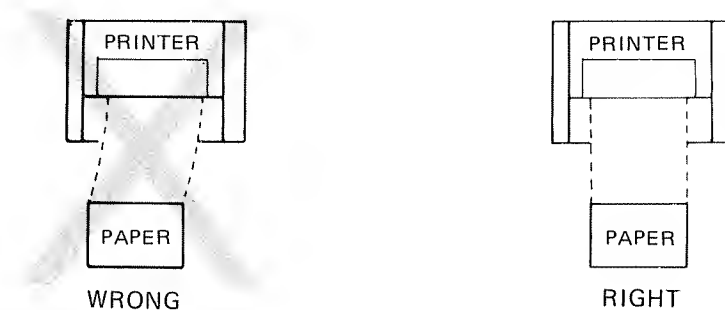
If the paper is correctly loaded, it should *enter between the body of the Printer and the Paper Separator.* Once the paper is loaded and power is ON, check the ALERT Indicator If the lamp is illuminated, press the RESTART Switch. If the lamp remains on, the paper is probably loaded incorrectly.

If the lamp is not illuminated after the paper is loaded, you may begin printing (if the power is ON).

Single-Sheet Paper Loading

1. Be sure the Power Switch is OFF.

2. Open the clear visor.

3. Gently move the Print Head Control Lever away from the paper.

4. Move the Platen Pressure Lever forward (towards the front of the Printer).

5. Tilt the Paper Bail Lever forward.

6. Insert the paper into the Paper Insertion Opening and push the Platen Pressure Lever back towards the rear of the Printer. Use the Paper Feed Knob to pull the paper around until it appears between the Platen and the Print Head.

7. Move the Platen Pressure Lever forward to align the paper. Push the Platen Pressure Lever back again.

8. Tilt the Paper Bail back towards the rear of the Printer.

9. Set the Print Head Control Lever to the appropriate position.

   ⊚ Single-Part Forms. Move the Lever towards the paper as far as it will go.

   ⊚ Multiple-part Forms. Move the Lever as far as it will go toward the Platen without smudging the paper. Check for smudging by moving the Carriage back and forth at each of the Lever settings.

   Warning! The Print Head Control Lever must always be set as close to the Platen as possible; otherwise damage to the Print Head may result.

10. Close the Clear Visor.
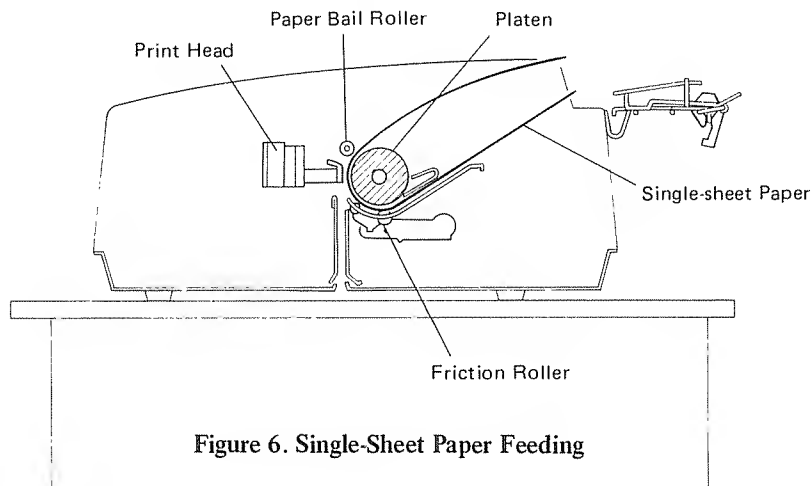
Figure 6. Single-Sheet Paper Feeding

Hints and Tips On Single-Sheet Paper Loading . . .

⊚ With the paper properly installed, printing will continue until the paper passes the Paper Empty Sensor. The Printer will then go OFF-LINE. Insert another piece of paper and turn the Paper Feed Knob to advance the paper. When the paper is in place, press the RESTART Switch and the DMP-420 will continue printing from where it left off, without loss of data in the print buffer. When the Paper Empty Sensor is triggered and the Printer goes OFF-LINE, you can press the RESTART Switch and one more line is printed. By pressing the RESTART Switch once for each line, you can print as close to the bottom of page as you want.

⊚ Remember to set the Platen Pressure Lever and the Paper Bail Lever toward the rear of the Printer while using single-sheet paper.

⊚ The Friction Feed system may be used with the tractor installed; however, better operation can be achieved if it is removed — especially when using single sheets of paper.

Fanfold Paper Loading

The DMP-420 will accept standard fanfold paper that is from 4" to 15" wide. The paper may contain one original and up to two copies.

Before using fanfold paper, however, the Tractor unit should be installed.

To load fanfold paper into the DMP-420:

1. Set the Power ON/OFF Switch to OFF.

2. Open the Clear Visor.

3. Move the Print Head Control Lever *away* from the paper.

4. Gently move the Platen Pressure Lever and the Paper Bail Lever *towards the front of* the Printer.

5. Raise the Pin Feed Paper Clamps to the side.

6. Insert the paper into the Paper Insertion Opening and push the Platen Pressure Lever back towards the rear of the Printer.

   Use the Paper Feed Knob to pull the paper around until it appears between the Platen and the Print Head. Be sure the paper lines up straight so that the holes will line up with the pin feed sprockets. Move the Platen Pressure Lever forward to align the paper; since pin feed paper is being used, leave the Platen Pressure Lever in the forward position.

7. Close the Pin Feed Clamps to secure the paper.

8. Set the Print Head Control Lever as follows:

   - Single-Part Forms. Move the Lever towards the paper as far as it will go.
   - Multiple-Part Forms. Move the Lever as far as it will go toward the Platen without smudging the paper.
   Check for smudging by moving the Carriage back and forth at each of the Lever settings.

   Warning! The Print Head Control Lever must always be as close to the Platen as possible; otherwise damage to the Print Head may result.

9. Move the Paper Bail Lever towards the paper.

10. Close the clear visor.
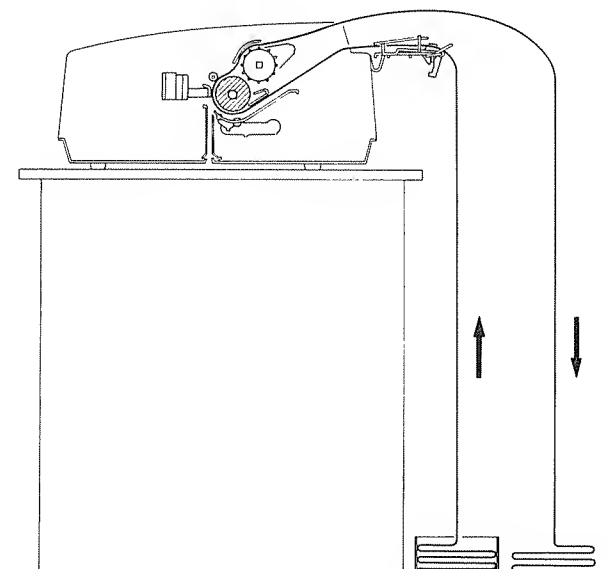
Figure 7. Fanfold Paper Feed (Rear Feed)   Figure 8. Fanfold Paper Feed (Bottom Feed)
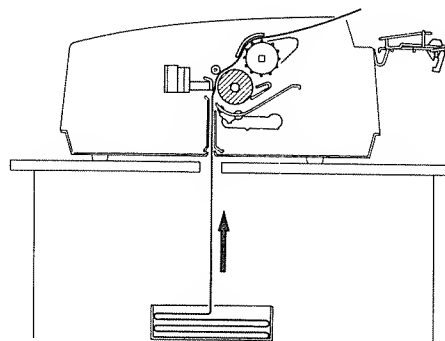
11

Hints and Tips On Fanfold Paper Loading . . .

- Whenever pin feed paper is used, the Platen Pressure Lever must be toward the front of the Printer. For friction feed paper, set the Lever to the rear of the Printer to apply Pressure to the paper.

- Remember to set the Platen Pressure toward the front of the Printer Lever and the Paper Bail Lever toward the rear of the printer while using fanfold paper.

- Be sure that the paper is positioned so that it can travel through the Printer without binding.

- *Do not let paper* pile up on top of unprinted paper or printed paper may be pulled back into the Paper Insertion Opening. This could jam the paper feed or damage the Printer.

Ribbon Installation/Replacement

If the Ribbon Cassette is already installed, simply check to see that it is properly threaded between the paper and Print Head.

If the Ribbon Cassette is not installed, or if it must be replaced due to excessive wear, faint printing, etc., follow this procedure:

1. Set the Power switch to OFF. (**Note:** When you turn the power OFF, any information stored in the Printer's buffer will automatically be lost.)

2. Open the Top Cover and *gently* move the Print Head Control Lever *towards the front* of the Printer as far as it will go.

3. Gently grasp the both sides of Paper Bail, lifting it upwards until it is firmly secured by the "stopper claws."

4. Gently grasp the Ribbon Cassette at the corners nearest the paper (towards the rear of the Printer) and remove the Cassette by lifting it upwards.

5. Unwrap the new Cassette and remove the packing foam.

   Before inserting the new Cassette, tighten the Ribbon by turning the Knob in the direction indicated by the arrow.

6. Gently press the Cassette down until it is firmly secured by the "stopper claws."

   Do not force the Cassette into place! If the Cassette is not properly fitted, the Cassette knob will not match up with the shaft from the Carriage. Do not force the Cassette down but fit it in gradually while turning the Cassette knob in the indicated direction.

7. Once the new Cassette is installed, *gently slide the ribbon in between the plastic ribbon guide and the guide plate.* Tighten the ribbon by moving the Carriage from side to side several times.

8. Move the Carriage back and forth manually to check that the ribbon advances properly. If the ribbon has not been properly fitted between the paper and Print Head (i.e., into the Print Head Ribbon Guide Bezel), the Ribbon feed will not operate smoothly. (See Figure 9.)

9. Move the Print Head Control Lever towards the rear of the Printer.

10. Gently press the Paper Bail Lever into place.

11. Close the Top Cover.

Remember! It is extremely important that the Print Head is as close to the paper as possible; otherwise damage to the Print Head may occur. Simply move the Print Head Control Lever towards the paper and move the carriage back and forth until smudging occurs. Then gradually move the Print Head away from the paper until the smudging stops.
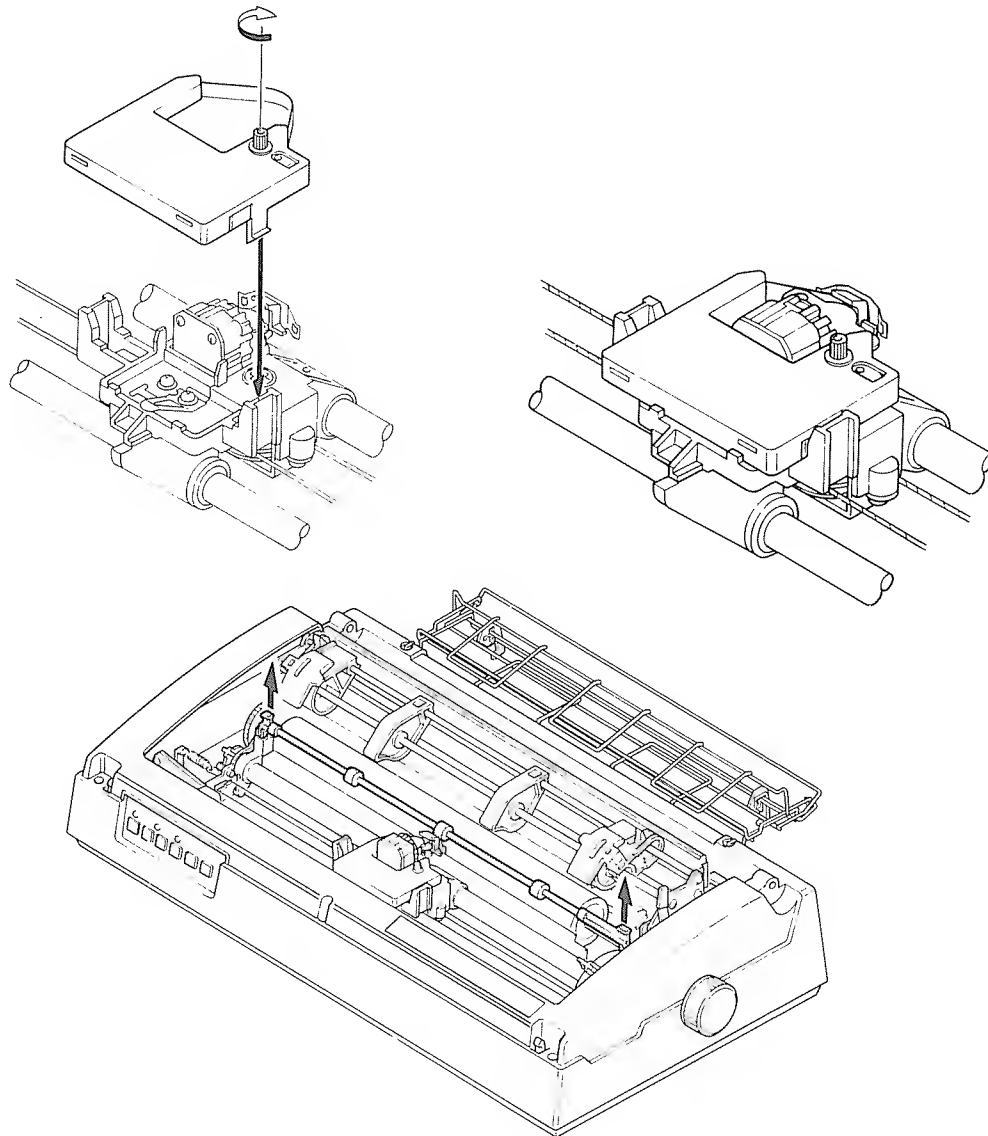
Figure 9. Installed Ribbon Cassette

Setting Print Function (DIP) Switches

There are 8 Switches located on the left rear side of the Printer. These Switches allow you to customize some of the DMP-420 features for your own applications.

For instance, by setting the appropriate Switches *before turning the DMP-420's power ON*. You can select Word Processing Mode (better print quality) or Data Processing Mode (higher printing speed). Or, if you begin using the DMP-420 with a TRS-80 which has serial printer output (such as the Color Computer), turn the power OFF and set the appropriate Switch accordingly.

When you receive the DMP-420, these Switches should be set to OFF (i.e., in the down position).

Remember! The Printer power must be OFF before you change any of the Switches.

LP–VI   Serial   NL   Modified ASCII

600 BPS   WP   CR   Kana

ON ↑   ↕ ON

1   2   3   4   5   6   7   8   ↓ OFF

1200 BPS   DP   NL   European

DMP–420   Parallel   LF   ASCII
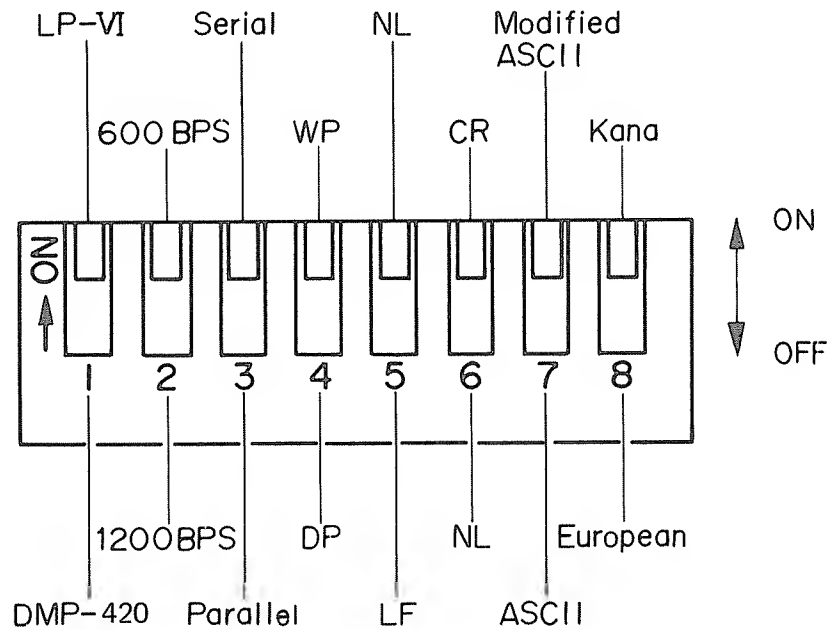
Figure 10. Print Function (DIP) Switches

If you've been using a Radio Shack Line Printer VI (26-1166) and still have applications programs that are designed to run on the LP VI, Switch #1 has been included for your convenience.

This Switch allows the DMP-420 to treat some codes just like the LP VI.

For instance. CHR$(27);CHR$(19) is used to set the LP VI into Graphics Mode. However, the DMP-420 uses a CHR$(18) to go into graphics Mode. Therefore, because Switch #1 has been provided, you won't have to change the program if it uses a CHR$(27);CHR$(19) to set the Printer into Graphics Mode — just set Switch #1.

When Switch #1 is in the "up" position (ON), the Line Printer VI codes are used.

When Switch #1 is in the "down" position (OFF), the new DMP-420 codes are used.

New DMP-420 Command Codes

If Switch #1 is set to OFF ▭, then the following codes are used:

If You Want To:	Use CHR$( ) Code:		Hex. Code	
Start Graphics Mode	18		12	
End Graphics Mode	30		1E	
Start Elongation	27	14	1B	0E
End Elongation	27	15	1B	0F
Standard character	27	19	1B	13
Condensed Character	27	20	1B	14
End Bold Character	27	32	1B	20
Half Reverse Line Feed	27	30	1B	1E

Table 1

Line Printer VI Command Codes

If Switch #1 is set to ON ▆▆, then these codes are used:

If You Want To:	Use CHR$( ) Code:		Hex. Code	
Start Graphics Mode	27	19	1B	13
End Graphics Mode	27	20	1B	14
Start Elongation	31		1F	
End Elongation	30		1E	
Standard Character	27	15	1B	0F
Condensed Character	27	14	1B	0E
End Bold Character	27	30	1B	1E
Half Reverse Line Feed	27	32	1B	20

Table 2

Remember! *Only change DIP Switch settings when the power is OFF.*

Setting the Rotary Switch

The Rotary Switch is located inside the DMP-420 just behind the Front Panel.

On power-up, it is used to select the desired character pitch (i.e., number of characters per inch — CPI). *Always set the Switch when the power is OFF.* This is also referred to as character spacing since the DMP-420 adjusts the space between the font style characters you have selected. The Switch can be set by hand, but a small screwdriver makes the job much easier.

When setting the Switch, the vertical groove must be positioned to the number you want.
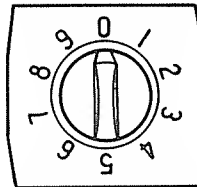
Figure 11. Rotary Switch Set to Position 0

Rotary Switch Settings

Position	Character Spacing	
0	Normal	10 CPI
1	Compressed	12 CPI
2	Condensed	16.7 CPI
3	Proportional	
4 ⎫		
5 ⎬	Correspondence	10 CPI
6 ⎪	Quality	
7 ⎭		
8	Normal	10 CPI
9	Compressed	12 CPI

Table 3

15

Connecting the DMP-420 to a Power Source

Before plugging the power cord into an AC power outlet, check the following:

☑ Is the Printer Power ON/OFF Switch set to OFF?
☑ Don't connect the Printer to the Computer yet.

Connect the AC power plug to a 3-wire, 120 volt, 60 Hz grounded AC outlet (220/240v, 50 Hz where the unit is so marked) or an approved power strip, such as the Radio Shack Plug-In Power Strip (61-2619) or the Automatic Power Sensor, SW-301 (26-1429).

Carriage Movement Test

The Carriage Movement Test allows you to check that the Carriage moves freely from one end of the Platen to the other and that the Platen is turning properly.

Printing is not performed during the Carriage Movement Test.

1. Set the ON-LINE/OFF-LINE Switch to ON-LINE.

2. Press and hold the RESTART Switch while setting the Power Switch to ON. The Carriage will move back and forth, performing a Line Feed at the end of each line.

3. Turn the power OFF to end the Carriage Movement Test.

Self-Test

The DMP-420 has a "built-in" self-test feature which lets you check printing quality and general printer operation before you connect the Printer to a TRS-80. This is a good time to check that the Print Head is adjusted properly (printing is neither too faint or smudged) and the paper is feeding properly.
The Self-Test will last for several minutes.
Before running the Self-Test, however, always the sure to load the DMP-420 with wide paper (15" wide) since the Test prints from one end of the Platen to the other. *Printing on the Platen can shorten the life of the Platen and the Print Head.*

To run the Self-Test:

1. Plug the Printer into an AC power outlet.

2. Set the ON-LINE/OFF-LINE Switch to OFF-LINE.

3. Press and hold the RESTART Switch.

4. Set the Power ON/OFF Switch to ON.
   The Printer will begin printing rolling ASCII 96 characters, according to the Font Style Selection Switch (Rotary Switch).

5. Printing will continue until you turn the power OFF.

Connecting the DMP-420 to a TRS-80

Before making any connections between the Printer and TRS-80, be sure all units are off!

You must also be sure you have the correct cable for your TRS-80 if the DMP-420 is to operate properly. Table 4 describes the printer cables Radio Shack provides; Table 5 provides a quick reference for printer connection locations.

TRS-80 to DMP-420 Cables

TRS-80	Cable Number
Model I (Keyboard only)	26-1411(available through National Parts)
Model I (Exp. Interface)	26-1401
Model II/16/DT-1	26-4401
Model III	26-1401
Color Computer	26-3020

Table 4

TRS-80 Connection Points

TRS-80	Connector
Model I (Keyboard only)	Rear of Keyboard
Model I (Exp. Interface)	Left side of E.I.
Model II/16	Rear Panel of Computer
Model III/DT-1	Underneath Panel
Color Computer	Rear Panel of Computer

Table 5

1. Attach the molded male end of the cable to the connector on the left rear side of the Printer.

   Do not force the plug. If it doesn't fit one way, turn it over and try again.

2. Connect the other end of the cable to the Printer Jack of your Computer. See your TRS-80 owner's manual for specific instructions.

Power-Up Sequence

The specific power-up sequence will depend upon your Computer. We suggest you consult your TRS-80 owner's manual for details on powering up your TRS-80 with peripheral devices (such as printers).

In any event, the Power Lamp will remain lit while the Printer is ON.

It is essential that the Printer remain ON when connected to the Computer. If you turn the power ON or OFF, or a Printer is connected but not turned on, erratic operation of the entire system may occur.

3/Using the DMP-420
(General Printer Operation)

The DMP-420 is designed for three distinct applications:

- Data Processing
- Word Processing
- Graphics Printing

The Printer has three different ways it responds to software codes from the TRS-80 — one for each application. The three response patterns, or modes, have many similarities, but each has its own unique features.

Data and Word Processing Modes are used for printing characters. The only difference between these two modes is the way they handle Line Feed commands (commands that decide which direction and how far the paper is fed).

- In the Word Processing Mode, each Line Feed command causes immediate paper advancement. Word Processing programs (such as SCRIPSIT) can use immediate line feeds for superscripts, subscripts, and the like.
- In the Data Processing Mode, Line Feed Commands do not cause immediate printing. Instead, they are stored in the Printer's memory along with the other data. When the current line is printed, the Line Feed commands stored in memory determine the direction and pitch of the paper feed.

Both Data and Word Processing can print in different Printer Font Styles and in different Pitches (character spacing). One font style is the Proportional character set and the other is Monospaced character set.

- **Proportionally spaced characters** have variable widths: an M takes up more space than an I. Proportional characters are used to create professional looking documents.
- **Monospaced characters** are so named because each character takes up the same width. This uniformity makes it preferable for tables and charts that require vertical alignment.

The font styles are determined by the dot-matrix pattern. Monospaced characters use a 9 x 9 and 15 x 9 matrix, while Proportional spaced characters use an n x 9 matrix.

The Print Pitch (character spacing) is determined by the space the DMP-420 puts between each printed character and also by the Font Style. Consequently, you must think of Pitch in terms of the number of characters printed per inch — 10 CPI, 12 CPI, and 16.7 CPI for Standard printing and 5 CPI, 6 CPI, and 8.3 CPI for Elongated printing.

In Graphics Mode, you have complete control of the Print Head. This mode can be used to create a custom letterhead, designs, special type fonts, etc.

However, with Graphic operation, many control codes (which can be used with Data and Word Processing) cannot be used. The DMP-420 doesn't return an error when you send such a code — it simply ignores the code. This includes codes that change line feed pitch and direction. Graphics Mode uses only one line feed (7/72") to insure full coverage of the paper.

Control Codes

Before investigating the various print modes, consider how the TRS-80 communicates with the Printer.

All information is sent to the Printer as numbers between 0 and 255 decimal (00 — FF for you hexadecimal fans). The Printer interprets these numbers according to the American Standard Code for Information Interchange, commonly referred to as the ASCII code. (See

Appendix A for a list of ASCII codes.) Most numbers (or codes) are printed as letters, numbers, or symbols. However, the numbers 0 — 31, as well as some special sequences of code numbers, are used to "control" various functions of the Printer. These "Control Codes" allow you to change character sets, select print modes, underline, superscript, subscript, etc.

The Control Codes have different meanings, depending on the current print mode. If a Code is not recognized by the Printer, it is printed as $\overline{X}$. The next few sections demonstrate how some of the Control Codes activate various Printer functions. Read these sections carefully.

Sending Control Codes from BASIC

Some Printer features are activated by a single code, but many functions require a sequence of two or more codes. Most multiple code sequences begin with decimal 27 (referred to as the "ESCape" code). The ESC code notifies the Printer that a special sequence is on its way. The next code(s) sent determine which Printer feature is selected. In BASIC, use CHR$( ) to send these codes to the Printer.

Note: This section will use the command LPRINT in examples that send codes to the Printer. If you're using a TRS-80 Color Computer, substitute PRINT#-2, for LPRINT.

For instance, set up the DMP-420 as described earlier and enter BASIC in the normal way. Then type the following program:

```
10 REM
20 LPRINT ''DATA'';CHR$(27);CHR$(28);''PROCESSING''
30 LPRINT ''MODE''
```

and RUN it.

Roll the paper forward and look at the results. The word MODE printed over part of the word DATA. Why? The codes CHR$(27) and CHR$(28) are the guilty parties. Take a quick look at Appendix A. This chart shows the various code sequences understood by the DMP-420. The Control Code sequence CHR$(27);CHR$(28) means "change the forward line feed to half its normal distance".

Data Processing Mode

How can you tell which mode the DMP-420 uses when it's first turned on? A little reflection on the above program tells you all you need to know.

Line Feed commands are executed immediately in Word Processing (WP) Mode, but not in Data Processing (DP) Mode. The (27 28) sequence didn't cause a Half Forward Line Feed until after the first line was printed. Thus, the Printer must be in DP Mode. And, in case you missed it, this new Line Feed stays in effect until further notice (another characteristic of DP Mode).

Type: LLIST (ENTER)

Sure enough. You still have that short Line Feed.

Word Processing Mode

If the same program were executed in WP Mode, the Line Feed would have occurred immediately after the word DATA. Go into WP Mode and try it. To enter WP Mode, change line 10 to:

```
10 LPRINT CHR$(20) :REM CHR$(20) SELECTS WP MODE
```

and RUN the program.

Just as you suspected, the Line Feed is immediately executed.

Note that in WP Mode, the new Line Feed is only temporary. Type: LLIST (ENTER) to prove that the Half Forward Line Feed doesn't occur.

Graphics Mode

Graphics Mode is very different from the other two printer modes. For one thing, Graphics Mode accepts only one Line Feed code — CHR$ (10). This Line Feed is fixed at 7/72". Furthermore, only a few of the WP and DP features are available in Graphics Mode. Standard letters and symbols, for example, are ignored by the Printer when it is in Graphics Mode. Instead, numeric data from 128 to 255 is translated into dot patterns for the Print Head. This lets you produce high-resolution graphics print-outs of charts, logos, etc.

For a quick look at this Mode in action, change our test program to:

```
10 LPRINT CHR$(18)
20 FOR I = 128 TO 255
30 LPRINT CHR$(I);
40 NEXT
```

and RUN the program.

CHR$(18) puts the DMP-420 into Graphics Mode. The numbers 128 through 255 are interpreted as dot patterns.

Type: LPRINT CHR$(30) (ENTER) to return the Printer to WP Mode. Try LLISTing the program to be sure you're not stuck in Graphics land.

Selecting a Print Mode

Table 6 summarizes the Control Codes required to move from one mode to another.

If you're in:	and want to change to:	Send a CHR$( ):	Hex. Code
DP	WP	20	14
	Graphics	18	12
WP	DP	19	13
	Graphics	18	12
Graphics	DP	30 *	1E
	WP	30 *	1E
*Returns to last Mode (WP or DP) used.			

Table 6

Hints and Tips About Print Modes . . .

Data Processing Mode

- All commands which decide Line Feed pitch and the direction of movement are stored in the Printer's memory. They are not executed until a LF code (10 Dec. or 138 Dec.) is received. Then, the paper advances according to the pitch and direction codes stored in the Printer's memory.
- Line Feed commands stay in effect until replaced by a new command.
- All printable characters (except user-defined Graphics) can be printed in this mode.

Word Processing Mode

- Line Feed codes that determine pitch or direction are executed immediately.
- Line Feed pitch and direction changes affect only the current print line.
- All printable characters (except user-defined Graphics) can be printed in this mode.

Graphics Mode

- This mode is very different from the other two modes. In Graphics Mode, only one Line Feed code (10 Dec.) is acceptable. The LF code causes the paper to move 7/72" forward. No other pitch or direction is allowed.
- Decimal numbers 128 — 255 sent via CHR$ in BASIC are interpreted as pin firing patterns for the Print Head.
- Only a few code sequences are recognized in Graphics Mode.

4/ Print Font Styles and Character Widths

The DMP-420 has four distinct print (character) font styles:

- Standard
- Correspondence Quality
- Proportional
- Graphic Characters

Each font style is created with a unique dot pattern laid out in a grid or matrix.

The character styles differ in the size of the matrix and the way individual characters are created within the matrix.

The horizontal dot positions overlap; the vertical ones don't.

Character Widths and Densities		
Font Style	**Matrix Size**	**Pitch**
Standard	9x8	Normal 10 CPI / Elongated 5 CPI Compressed 12 CPI / Elongated 6 CPI Condensed 16.7 CPI / Elongated 8.35 CPI
Correspondence Quality	15x8	Normal 10 CPI / Elongated 5 CPI
Proportional	nx8	Variable width (Condensed)
Block Graphics	6x6	Normal 10 CPI Compressed 12 CPI Condensed 16.7 CPI

Table 7

Table 7 shows that there are three basic Pitches:

- Normal
- Compressed
- Condensed

If a font style is changed in a line without changing the pitch, the line is printed continuously without pausing. For example, the DMP-420 will not pause while changing from Standard Condensed 16.7 CPI printing to Correspondence Quality 10 CPI printing, since both use the same dot density. On the other hand, if the density of the new style character is different from the preceding one, the Printer will print the current buffer contents, leave some blank space, then resume printing in the new character style. For example, this will happen if you change from Standard Compressed to Correspondence Condensed. Standard Condensed, Correspondence, and Proportional characters all have the same dot density. Standard Normal and Compressed are unique unto themselves.

Selecting Font Styles

Character font styles may be selected by the Rotary Switch setting before power-up (i.e., via hardware) or by Control Codes from the TRS-80 (i.e., via software) during operation.

The Rotary Switch determines the character style selected on power-up; after that, you control the styles via Control Codes.

Font styles stay in effect until another font style is selected. Even entering Graphics Mode does not change the font. The DMP-420 returns to the last active font on leaving Graphics Mode.

Table 8 is a summary of the Character Style change commands:

Set Rotary Switch To:*	Or Send a CHR$( ):		Hex. Code		If You Want:
0 or 8	27	19	1B	13	Normal
1 or 9	27	23	1B	17	Compressed
2	27	20	1B	14	Condensed
3	27	17	1B	11	Proportional
4-7	27	18	1B	12	Correspondence Quality
	27	14	1B	0E	Start Elongation
	27	15	1B	0F	End Elongation
	27	31	1B	1F	Start Bold
	27	32	1B	20	End Bold

* Rotary Switch must be set before power-up.

Table 8

Note: Line Printer VI uses codes (15) for Standard and (14) for Condensed.

Standard Character Font Style

The Standard character set is printed in a 9x8 dot-matrix (9 dots wide by 8 dots high).

Each of the Standard characters can be printed in three main character widths:

- Normal 10 Characters Per Inch (CPI)
- Compressed 12 CPI
- Condensed 16.7 CPI

Each of these widths can be elongated (double-width), which gives half as many characters per inch and a total of 6 different print widths.

You can get a better feel for the different available print widths by printing a few sample lines. Type in this program:

```
NEW (ENTER)
110 F$=''STANDARD ''
120 N=19:W$=''NORMAL '':GOSUB 240
130 N=23:W$=''COMPRESSED '':GOSUB 240
140 N=20:W$=''CONDENSED '':GOSUB 240
230 LPRINT CHR$(27) CHR$(19):STOP
240 LPRINT CHR$(27)CHR$(N) F$ ''CHARACTERS '';W$;''DENSITY ''
250 RETURN
```

and RUN it.

The subroutine in line 240 sends the required Control Codes to the DMP-420. Line 230 returns to Normal character width and stops program execution.

24

Correspondence Quality Font Style

The second character set is a 15 x 8 dot-matrix character set for Correspondence Quality 10 CPI. The characters have the same total width as Normal width characters, but they are printed with the Condensed character density (15 dots wide fits in the same space as 9 dots wide). Correspondence Quality print can be elongated to 5 CPI.

Correspondence Quality characters appear to be the same as Standard characters in Normal width, but they are an entirely unique character style. Add these lines to the program, then compare the two styles.

```
150 F$ = ``CORRESPONDENCE '': LPRINT
160 N = 20: W$ = ``CONDENSED '': GOSUB 240
```

Now RUN the program.

The difference between some characters is very slight, but the O and W are quite different. This is a good style to use with word processing programs that do not support proportional characters.

Proportional Spacing Font Style

The third character set is the Proportional spaced character set. This character font style is the same as Correspondence Quality, but the character matrix width varies from character to character. The characters are 8 dots high; the widths vary from 10 dots to 20 dots (including 5 columns of blank dots to allow space between the characters).

Proportional characters add a quality look to word processing documents by eliminating wide gaps between characters. These characters can also be elongated to double their normal width.

Graphics Characters

The fourth character set is a 6 x 6 dot-matrix character set used for Block Graphics printing. The characters can be Normal 10 CPI width, Compressed 12 CPI, or Condensed 16.7 CPI. This set is not fully compatible with the screen graphics of most TRS-80 computers; it is a unique character set.

A 6 x 6 dot-matrix character set is available in Normal 10 or 5 CPI, Compressed 12 or 6 CPI, and Condensed 16.7 or 8.3 CPI character conditions. The Graphics characters are not available with Correspondence characters or Proportional characters.

To see how the various character widths affect the Graphics characters, add:

```
190 N = 19: W$ = ``NORMAL '': F$ = ``GRAPHIC '': LPRINT
200 GOSUB 240: GOSUB 260
210 N = 23: W$ = ``COMPRESSED '': GOSUB 240: GOSUB 260
220 N = 20: W$ = ``CONDENSED '': GOSUB 240: GOSUB 260
260 FOR I = 224 TO 254: LPRINT CHR$(I);: NEXT I
270 LPRINT: RETURN
```

and RUN the program.

Since the normal line-to-line spacing is 1/6″ or 12 dots high and the Graphics characters are 6 dots high, we can create continuous vertical graphics by using the Half Forward Line Feed (CHR$(27); CHR$(28)). Add these lines to the program:

```
10 LPRINT CHR$(27);CHR$(28);
20 FOR R=1 TO 3
30 FOR C=1 TO 7
40 READ N: LPRINT CHR$(N);
50 NEXT C: LPRINT
60 NEXT R: LPRINT CHR$(27);CHR$(54);
70 DATA 241,243,241,224,241,243,241
80 DATA 224,244,241,241,241,249,224
90 DATA 241,248,241,224,241,248,241
```

and RUN it.

When you've printed out the results, delete lines 10 through 90.

Right Justification

Proportional characters are designed to be used with word processing programs. They don't carry around all the wasted space between words that monospaced print styles do. As a result, you can sneak in little slivers of space between characters to line up the right margin of text on a page without destroying the nice character spacing. This process, called "Right Justification," is usually handled by word processing software. The DMP-420 provides codes to allow you to insert spaces between characters ranging from 1 dot to 9 dots wide.

You can demonstrate the way these codes work by modifying the current program. When you add the following two lines, the DMP-420 will print two lines of Proportional characters, then insert enough space to line up the right margins.

```
70 DATA ''THE PROPORTIONAL CHARACTER SET OF THE''
80 DATA ''DMP-420 PRINTER CAN BE RIGHT JUSTIFIED''
```

The lines will be read in as a string of characters with the MID$ function. Enter:

```
10 LPRINT CHR$(27);CHR$(17);
20 FOR I=1 TO 2: READ A$
30 FOR J=1 TO LEN(A$)
40 LPRINT MID$(A$,J,1);
50 REM
60 NEXT J: LPRINT: NEXT I
90 LPRINT CHR$(27);CHR$(19): END
```

Now RUN the program.

To line up the right edge, insert a single blank dot column between the first 22 letters in the second print line. Add:

```
50 IF I=2 AND J<22 THEN LPRINT CHR$(27);CHR$(1);
```

then RUN the program.

Table 9 may help when inserting spaces.

Send CHR$( ):	Hex. Code	To Insert This Much:
27 01	1B 01	1 Dot Space
27 02	1B 02	2 Dot Spaces
27 03	1B 03	3 Dot Spaces
27 04	1B 04	4 Dot Spaces
27 05	1B 05	5 Dot Spaces
27 06	1B 06	6 Dot Spaces
27 07	1B 07	7 Dot Spaces
27 08	1B 08	8 Dot Spaces
27 09	1B 09	9 Dot Spaces

Table 9

If a Proportional spacing command is used at the end of text (exceeding a line length), it generates a line-full condition. Printing will start and a Proportional spacing command will begin at the start of the next line. If several kinds of Proportional spacing commands in succession at the end of text are used, and if the row of Proportional spacing commands causes a line-full condition, only the last Proportional spacing command is set at the head of the next line.

Delete lines 10 through 90 of your sample program before going on.

Wrap-Around

The DMP-420 is a dot-addressable printer. Therefore, line length is not determined by the number of characters, but by the number of dots-per-line. The numbers of addressable dots-per-line in Data Processing or Word Processing Mode are:

- Normal = 1584
- Compressed = 1900
- Condensed = 2640
- Proportional = 2640
- Correspondence Quality = 2640

If the length of text the Printer receives exceeds the limit of dots-per-line, a Line Feed is inserted and the last character is printed from the start of the next line. This is called "wrap-around."

If you print two or more different pitches on the same line, calculation of the line length can be somewhat complicated. Proportional dot spacing can be used to adjust for the different densities.

Elongated Characters

Any of the character font styles can be elongated to twice their normal width.

Elongated Printing		
Send CHR$( ):	Hex. Code	To:
27 14	1B 0E	Start Elongation
27 15	1B 0F	End Elongation

Table 10

The start (27 14) and end (27 15) codes for Elongated characters may be entered any number of times within a line and can be used in every mode.

You can easily elongate the characters in the current program. Change:

```
100 LPRINT CHR$(27);CHR$(14)
230 LPRINT CHR$(27);CHR$(19);CHR$(27);CHR$(15): STOP
```

and RUN the program.

Bold Characters

Bold characters are implemented in much the same way as Elongated characters.

Bold Printing			
Send CHR$( ):	Hex. Code		To:
27 31	1B 1F		Start Bold Printing
27 32	1B 20		End Bold Printing

Table 11

With the Line Printer VI, Bold characters start when you send a CHR$(27);CHR$(31) and stop when you send a CHR$(27);CHR$(30).

When a (27 31) code sequence is received, the DMP-420 prints the current buffer contents; then it resumes Bold character printing from the next character received.

Bold characters can be added to the current program by changing lines:

```
100 LPRINT CHR$(27);CHR$(31)
230 LPRINT CHR$(27);CHR$(19);CHR$(27);CHR$(32):STOP
```

and RUNning it.

Mixing Bold and Elongated

Bold and Elongated characters cannot be active at the same time. The first code (either Bold or Elongated) to be received and activated will take precedence. The DMP-420 then simply ignores the second code.

5/ General Control Codes

Line Feed Codes (LF)

When a LF code (ASCII 10) is received by the DMP-420, all data in the Printer buffer is printed followed by a Line Feed. Unless you tell it otherwise, the DMP-420 uses 1/6" forward Line Feed when advancing paper.

If DIP Switch #5 is ON (in the *up* position), a Carriage Return is also performed with the Line Feed, moving the Print Head to the start of the next print line. If Switch #5 is OFF, the Print Head stays in the current print column and moves down one line.

Other Line Feed codes control the pitch and direction of the Line Feed. In DP Mode, these codes may be stored in the buffer. In WP Mode, they cause immediate printing.

Pitch and direction settings are sent to the DMP-420 in a two-code sequence. First, a Control Code 27 is sent (CHR$(27)). This tells the DMP-420 that a special code sequence will follow. The next number determines the specific pitch and direction. These Control Codes are listed in Table 12.

Line Feed Control Codes			
Send CHR$( ):	**Hex. Code**		**To:**
27 10	1B 10		Full Reverse Line Feed (1/6")
27 28	1B 1C		Half Forward Line Feed (1/12")
27 30	1B 1E		Half Reverse Line Feed (1/12")
27 54	1B 36		Full Forward Line Feed (1/6")
(Ignored in WP Mode).			
27 56	1B 38		Three-quarter Forward Line Feed (1/8")

Table 12

Hints and Tips On Line Feed . . .

● In Data Processing Mode, codes are stored in the Printer buffer. They are not activated until a LF code is sent. In the Word Processing Mode, these sequences cause the Printer to print the information in its buffer, then execute a Line Feed with the specified pitch and direction.
● CHR$(27);CHR$(10) will not work from BASIC with the CHR$ function. The LF code (10) is intercepted by BASIC and sent to the Printer as a 13.
● CHR$(27);CHR$(54) is ignored in Word Processing Mode since it duplicates the LF code.
● Line Feed pitch and direction codes have no effect in Graphics Mode. The Line Feed is set to 7/72" forward.
● If DIP Switch #5 is ON, a Carriage Return follows each Line Feed except for the 1/12 forward and 1/36 forward settings.

Special Line Feed Control Codes

There are two special forward Line Feed Codes that operate the same, regardless of the current print mode. They are:

Special Line Feed Control Codes		
Send CHR$( ):	Hex. Code	To:
27 50	1B 32	1/12 Forward Line Feed (1/72")
27 51	1B 33	1/36 Forward Line Feed (1/216")

Table 13

They are unique for two reasons:

- They cause an immediate dump of the Printer buffer followed by a Line Feed, regardless of the print mode.
- A Carriage Return is not performed, regardless of Switch #5.

These special Line Feed Codes are useful for adjusting a print line or printing a dot-matrix picture.

Carriage Return (CR)

A CR (13 or 141) Code tells the Printer to print the current buffer contents, and then perform a Carriage Return. If DIP Switch #6 is OFF, one line feed (the current active line feed) will be performed at that time. If Switch #6 is ON, a line feed is not activated and printing continues on the current line.

Backspace (BS)

The DMP-420 can be backspaced from one to 255 dot-columns when you send it a two-code sequence of which the first code is CHR$(8). The second code is in the form of CHR$(n), where n is a value from 1 to 255 and specifies how many dot-columns to backspace from the current Print Head position. For example:

    LPRINT CHR$(8);CHR$(150)

would backspace the Print Head 150 dot-columns from the current position.

In general, backspacing should be done in multiples of the current character size. That is, backspacing for the Standard character set should be 12 dots per character (9 dots plus 3 for spacing between characters). For instance, LPRINT CHR$(8); CHR$(24) would backspace two characters.

If n is 0, backspacing is not done. The repeat feature can be used to backspace more than 255 dot-spaces.

If n is greater than the current dot-position, printing starts at the beginning of the line. In Graphics Mode, the backspace code is ignored and n is treated as an independent character. Backspace works in both Data and Word Processing Modes.

The backspace command is a print command. Receiving the backspace command causes the DMP-420 to print out all data in the buffer and to execute a backspace operation.

Type in this program:

```
10 LPRINT TAB(30);``D P 4 0'';
20 LPRINT CHR$(8);CHR$(72);``M - 0''
```

and RUN it.

Go ahead and run it again. This time watch the action of the Print Head. The first string starts at Position 30. The trailing semicolon holds the position right after the zero. CHR$(8); CHR$(72); backspaces six normal character widths (12 dots each, remember?) to place the M right between the D and the P. You can imagine what would happen if the dot distance is miscalculated? Ouch!

To backspace over elongated characters, simply double the number of dots. Let's try it. Change the program to:

```
10 LPRINT TAB(30);CHR$(27);CHR$(14);``D P 4 Ø'';
20 LPRINT CHR$(8);CHR$(144);``M - 2''
30 LPRINT CHR$(27);CHR$(15)
```

and RUN the program.

CHR$(27); CHR$(14) and CHR$(27); CHR$(15) get the DMP-420 in and out of Elongated character width. Remember that you must compensate for the double-width characters by doubling the 72 in line 20 to 144.

The widths of the available character font styles are shown in Table 14. The Proportional character widths naturally vary from character to character.

Character Set Width

Font Style	Dots/Character	To Backspace	
		1 Character	n Characters
Normal 10 CPI	12	08 12 (08 0C)	08 12n
5 CPI	24	08 24 (08 18)	08 24n
Compressed 12 CPI	12	08 12 (08 0C)	08 12n
6 CPI	24	08 24 (08 18)	08 24n
Condensed 16.7 CPI	12	08 12 (08 0C)	08 12n
8.3 CPI	24	08 24 (08 18)	08 24n
Correspondence 10 CPI Quality	20	08 20 (08 0C)	08 20n
5 CPI	40	08 40 (08 18)	08 40n

Table 14

The Dots/Character include blank dots between characters.

Setting Top-of-Form and Form Length

The Control Code CHR$(27); CHR$(52) is used to set the Form Length in all three print modes. It resets the Line Feed count to zero and sets the current line as the Top-of-Form position. The line length per page is set to $n(\times 1/6'')$ to be used with the Form Feed code. If

n is 0 or 1, it is changed to 2. Whenever any Line Feed operation is activated, Line Feed pitch is counted up and compared with *n*(x1/6″).

On initial power-up, the DMP-420 sets the Top-of-Form at the current paper position and the Form Length is set to 66 lines per page. Be sure the paper is properly positioned before you turn on the Printer.

Form Feed (FF)

When a CHR$(12) command is received, the print buffer contents are printed out completely, paper is advanced to the next Top-of-Form position, and the Line Feed counter is reset to zero.

However, there is one slight problem for those of you who communicate to the Printer through BASIC. Most BASICs keep track of the Top-of-Form internally and intercept the Form Feed code on its way to the Printer and send out, instead, a series of line feeds. Since the FF code never makes it to the Printer, the CHR$(12) is not activated. Some BASICs can use the POKE or OUT statement to send a FF directly to the Printer and bypass the intercepter.

Important Note: Do not use CHR$(12) except for graphic applications. Radio Shack application programs have Top-of-Form "built-in." See your applications program user's guide for instructions on setting FORMS and the program will do the rest.

Ignored or Undefined Codes

Codes that are unusable or undefined in a given print mode are either ignored or printed with the symbol X̄ which represents an invalid code.

There are several reasons a code may be unusable in a certain mode. Redundant codes that don't change the current printer status are usually ignored. For example, if the Printer is in DP Mode, sending a CHR$(19) (used to enter DP Mode) is useless. And there are many ASCII control codes in the range 0 to 31 that the DMP-420 simply doesn't recognize. ASCII 0, for example, is not used in any of the three print modes.

The following summarizes the undefined print codes:

DMP-420 Ignored Control Codes

All Modes:
- Out of range on repeat sequence.
- Out of range on POS sequence.
- Redundant codes that don't change the current printer status. For example, if you send a CHR$(14) when underline is already set.

DP: 0, 1, 19, 30, 127, 255

WP: 0, 1, 20, 127, 255, 2754

Graphics: All codes in the range 0 - 127 are ignored, except (10), (12), (27 14), (27 15), (27 16 *n*1 *n*2), (28 *n*1 *n*2), (30), (27 50), and (27 51), (27 52 *n*).

Unprintable repeat sequence data *n*2 is also ignored.

Codes printed as X̄

DP and WP:
- All codes from 0 - 31 and 128 - 159, except the active function codes or

the above ignored codes.
- Unprintable repeat data $n2$.
- Standard, Compressed, Condensed if Switch #8 is OFF; codes 192 - 223 are printed as $\mathbf{X}$.
- Proportional or Correspondence, 192 - 254 are printed as $\mathbf{X}$.

Table 15

DMP-420 Buffer Operation

The DMP-420's ability to temporarily store data is one of its main advantages over a typewriter. Codes sent to a typewriter (i.e., keys pressed) are transferred immediately to the paper. Codes sent to a Printer are not printed immediately; they are stored in a separate section of memory in the Printer called the buffer. When the buffer fills, or certain codes are received (e.g., LF or CR), the buffer is emptied and all data is printed on the paper. What happens after the buffer data is printed depends on the circumstances. In some cases, printing continues on the same line; in others, the Print Head is moved to a different position relative to the paper.

In the DP Mode, commands for changing print fonts, Line Feed, etc., can be stored in the buffer to take affect when the data is dumped to paper.

Understanding how the buffer works is important for those who wish to gain full control of the DMP-420.

Hints and Tips on the DMP-420 Buffer . . .

For DP, WP, and Graphics Modes
- The buffer allocates a fixed number of dots, depending on the character width selected. The buffer is emptied when the data stored equals that number.
  Printing resumes at the start of the next line, unless Switch #6 is set to CR only.
  If different character widths have been used on the same line, the last character added may exceed the dot count. The buffer is printed without this last character.
- The last character received by the buffer is printed at the beginning of the next print line following an automatic Line Feed and Carriage Return.
- The Form Feed code (FF = 12 decimal) automatically activates printing (if the code makes it to the Printer).
  If LF only has been selected (Switch #5), then the buffer is printed and the Print Head moves to the next Top-of-Form line without a Carriage Return to the beginning of the line. Otherwise, the Print Head is positioned at the beginning of the next Top-of-Form line.
- The Carriage Return code (CR = 13 decimal) automatically activates printing (assuming at least one character code is already in the buffer).
  If Carriage Return only has been selected via hardware, the Print Head is moved to the beginning of the current line and the next buffer full will print over the current line. Otherwise, subsequent characters will be printed at the start of the next print line.
- The Line Feed code (LF = 10) automatically activates printing.
  If LF only has been selected (Switch #5), then the buffer is printed and the Print Head moves to the next print line without a Carriage Return to the beginning of the line. Otherwise, the Print Head is positioned at the start of the next print line.
- If the computer delays more than a second before sending the next print code, the buffer is printed. Printing continues from the current position.
- The Head Positioning sequence (27 16 $n1$ $n2$) prints the buffer.
  Printing continues in the current line at the dot address specified by the (27 16) command.

Data and Word Processing Modes only:

- The backspace command activates printing.
  Printing continues in the current line at the dot address specified by the command.
- If a character set of different dot density is selected, the data in the buffer is printed.
  Codes for changing character sets are: (27 17), (27 18), (27 19), (27 20), and (27 23).
  Printing continues in the current line with the new character style.
- Dot graphics printing continues from the current character position.
- When a start Bold or end Bold is received, the buffer is printed.
- Bold printing continues from the current character position.

Graphics Mode only:

- When the end Graphics Mode command is received, the Printer returns to the previous print mode and printing continues in the same line from the current print position.

  Note 1: In the description, "next line" means the new line performed by a Line Feed operation. In Data Processing Mode, if a Reverse Line Feed has been set in the memory, the Line Feed operation will cause paper to move in the reverse direction.

  Note 2: Repeat data can cause a buffer full condition, as well as an overflow by single characters.

Hex Print Mode

- The DMP-420 is capable of printing hexadecimal values for data that is transmitted to it. This "Hex Print Mode" is useful for checking exactly what information is being received by the Printer.

- To implement this function, turn on the power to the Printer while simultaneously holding down the ON-LINE, FORM FEED, LINE FEED, 1/2 FORWARD LINE FEED and 1/12 REVERSE LINE FEED buttons.

- Before printing, be sure that 15-1/2 inch paper is loaded in the Printer to avoid printing on the platen. Then press the ON-LINE button and run the program that you want to check.

  For example, the BASIC program line:

  ```
  10 LPRINT "NOW IS THE TIME FOR"
  ```

  will normally print out as

  NOW IS THE TIME FOR

  If you enter "Hex Print Mode", the printout will look like this:

  ```
  4E 4F 57 20 54 48 45 20 54 49 4D 45 20 46 4F 52 20
  (4E=N, 4F=O, 57=W, 20= Space, etc.)
  ```

  To exit "Hex Print Mode", turn the Printer off and then on again.

6/ Word and Data Processing Modes

Superscript and Subscript

In an earlier section, we described that the difference between Data and Word Processing Modes is how they handle Line Feed codes. (In Data Processing Mode, LF codes are stored until the end of the line and become the current line feed standard; in Word Processing Mode, these codes are executed immediately and are only temporary.)

Printing superscripts and subscripts is the ideal time to take advantage of the immediate response to Line Feed codes in Word Processing Mode. Type in this new program:

Note: For smooth Reverse Line Feeds, be sure the Platen Pressure Lever is towards the front of the Printer (i.e., Platen pressure is off), and keep the Paper Bail on the paper.

```
 10 E$=CHR$(27)  'ESC
 20 D$=CHR$(28)  'DOWN
 30 U$=CHR$(30)  'UP
 40 LPRINT CHR$(20)
 50 REM
 60 LPRINT "(X";
110 LPRINT E$ D$;"1";E$ U$;"+ X";
120 LPRINT E$ D$;"2";E$ U$;")";
130 LPRINT E$ U$;"2";E$ D$
```

and RUN the program.

In this program, frequently used codes are stored in variables E$, D$, and U$. This shortens the program a bit. The directions in lines 10 through 30 refer to the motion you would make drawing the script characters by hand. (Move down to do the subscripts 1 and 2, then back up to the output line. Then move up to do the superscript 2.)

Repeat Printing

The DMP-420 also provides a built-in repeat capability. You can use it to repeat a single character code up to 255 times. It's great for repeating graphics codes, underlining, repeated block graphics, etc. The Repeat features uses a three-code sequence:

- CHR$(28)
- The number of repetitions.
- The code to be repeated.

Since we already have CHR$(28) saved as D$ in the current program, let's try out the repeat sequence. Change:

```
50 LPRINT "  /";   '2 BLANK SPACES BEFORE THE /
60 LPRINT E$; U$;
70 LPRINT D$; CHR$(13); CHR$(241)
```

Code 241 is from the Graphics character set.

```
 80 LPRINT "  ";  '1 BLANK SPACE
 90 LPRINT CHR$(8); CHR$(7);
100 LPRINT CHR$(92); "/(X";
```

Now RUN the program.

With a little fancy footwork, you were able to line up the two slashes and came up with a rough approximation of a square root sign. Brings back bad memories, doesn't it?

Underline Printing

If you need to underline any text in either DP or WP Mode, send the DMP-420 a CHR$(15). All text that follows this code will be underlined until you send a CHR$(14) which stops underlining.

Underline Printing		
Send a CHR$( ):	Hex. Code	To:
15	0F	Start Underline
14	0E	Stop Underline

Table 16

For example, type in this short program:

```
10 LPRINT CHR$(20); :REM WORD PROCESSING
20 LPRINT CHR$(15); :REM START UNDERLINE
30 LPRINT ''LEEWAY BUSINESS PRODUCTS''
40 LPRINT CHR$(14); :REM STOP UNDERLINE
50 LPRINT ''GIVES GOOD SERVICE''
```

In this example, line 20 turns on the underline and the first line of text (LEEWAY BUSINESS PRODUCTS) is underlined. Line 40 turns the underline off and GIVES GOOD SERVICE is not underlined.

Print Head Positioning

In any mode, you can position the Print Head to a specific dot position.

Every other Print Head position is accessible through the positioning sequence. The characters stored in ROM can use the half step positions — you can't.

Using the Normal character sets (10 CPI), there are 1584 dot positions per line, but only half (792) are accessible by you. The same is true for Compressed and Condensed characters.

DMP-420 Print Head Positioning		
Character Width	Dots-per-Line	Available Columns
Normal	1584	792
Compressed	1900	950
Condensed	2640	1320

Table 17

Elongated characters use the same dot columns, even though the characters are printed twice as wide.

To position the Print Head to a specific position, send a (27 16), then two numbers (we'll call them *n*1 and *n*2) that specify the desired position. In other words, just follow this general procedure:

1. Send a Control Code which specifies the Character set (Normal, Condensed, Compressed).

2. Send a CHR$(27);CHR$(16) to tell the Printer you want to position the Print Head to print a specific dot-column.

3. Tell the Printer which dot-column you want to print.

   This is a little more complicated and will be explained shortly. For now, just understand that you simply tell the Printer which dot-column you want.

4. Tell the Printer what you want to print.

When you want to specify a dot-column for printing to begin, you must first use CHR$ to send the (27 16) code. Follow this with another two-code sequence which specifies the position. For instance:

LPRINT CHR$(27);CHR$(16);CHR$(*n*1);CHR$(*n*2)

where *n*1 is a value between 0-5 and *n*2 is a value between 0-255.

Print Head Positioning

If you wish to specify dot-column:	*n*1 must be:	*n*2 must be:
0-255	0	0-255
256-511	1	0-255
512-767	2	0-255
768-1023	3	0-255
1024-1279	4	0-255
1280-1319	5	0-39

Table 18

Remember! Normal printing allows you to access dot-columns up to 791 ($n1 = 3, n2 = 23$); Compressed printing allows you to access dot-columns up to 949 ($n1 = 3, n2 = 23$); Condensed printing allows you to access up to 1319 ($n1 = 5, n2 = 39$).

Why two numbers ($n1$ and $n2$)? The maximum value you can send to the DMP-420 with one number is 255, and clearly you have more than 255 dot positions available.

Those of you who are fans of binary math will recognize that the DMP-420 is interpreting these two numbers as a single 10-bit (b(0) -b(9)) value. The two lower bits of $n1$ are used as b(8) and b(9).

Note: Use 15″ wide paper for this next example.

See if you can print a character starting in position 792 in Normal density. $n1 = 3$ gives 768 of those dots, and 792 - 768 = 24 is the difference to be sent as $n2$. Type:

```
10 LPRINT CHR$(27);CHR$(16);CHR$(3);CHR$(24);``*''
```

and RUN the program.

Whoops! The asterisk printed at the left edge of the paper. Hmmm? Maybe you need to leave enough room for the asterisk to fit on the end of the line. Try:

```
10 LPRINT CHR$(27);CHR$(16);CHR$(3);CHR$(18);''*''
```

and RUN. That's better. It fits nicely at the end of the line. Try this program with the different character densities.

Position is a little like a TAB, but it gets right down to the dot level, giving you much finer control. Although it is available in all three print modes, its potential is greatest in Graphics Mode.

If you want to make a real mess on you paper, try:

```
10 LPRINT CHR$(27);CHR$(28);
20 FOR I = 1 TO 100
30 LPRINT CHR$(27);CHR$(16);CHR$(1);CHR$(150+I*SIN(I/5));
40 LPRINT ''*''
50 NEXT I
```

and RUN the program.

But get out of double-width first!

7/ Graphics Mode

In Graphics Mode, you no longer have pre-defined characters at your disposal. You are responsible for the positioning and the action of the Print Head.

The DMP-420 allows you to have direct, programmable control over all of the available graphic dots.

How many "across the paper" addressable dot-columns are there? That varies, depending on the character style you're using. See Table 19.

DMP-420 Print Head Positioning

Character Style	Available Dot-Columns
Normal	792
Compressed	950
Condensed	1320

Table 19

How many "up and down" (dot-columns) addressable dots are there? The answer is 7.

That means you can specify any one of up to 9,240 individual dots (7 x 1320 = 9240).

How do you print just one (or two or three) of those dots in the dot-column you want? (For example, how can you print the 3rd dot from the top in the 400th dot-column?)

Simple. Just follow this general procedure:

1. Send a Control Code which specifies the character set (Normal, Condensed, Compressed).

2. Send a CHR$(18) to put the DMP-420 into Graphics Mode.

3. Send a CHR$(27);CHR$(16) to tell the Printer you want to position the Print Head to print a specific dot.

4. Tell the Printer which dot-column you want to print.

   This is a little more complicated and will be explained shortly. For now, just understand that you simply tell the Printer which dot-column you want.

5. Tell the Printer what you want to print. You can do this a number of ways. Again, this will be explained in more detail shortly. For now, just keep this overall procedure in mind.

When you want to specify a dot-column for printing to begin, you must first use CHR$ to send the (27 16) code. Follow this with another two-code sequence which specifies the position. For instance:

LPRINT CHR$(27);CHR$(16);CHR$($n$1);CHR$(n2)

where n1 is a value between 0-5 and n2 is a value between 0-255.

Graphic Dot Positioning		
If you wish to specify dot-column:	n1 must be:	n2 must be:
0-255	0	0-255
256-511	1	0-255
512-767	2	0-255
768-1023	3	0-255
1024-1279	4	0-255
1280-1319	5	0-39

Table 20

Remember! Normal graphic printing allows you to access dot-columns up to 791 ($n1 = 3$, $n2 = 23$); Compressed graphic printing allows you to access dot-columns up to 949 ($n1 = 3$, $n2 = 23$); Condensed graphic printing allows you to access up to 1319 ($n1 = 5$, $n2 = 39$).

Even though dot-columns greater than 255 exist, you cannot send values greater than 255. That is, CHR$(400) is not allowed — you must break it into a two-byte value.

For instance, to draw a vertical bar at dot-column 144, try this program:

```
10 LPRINT CHR$(18)
20 LPRINT CHR$(27);CHR$(16);CHR$(0);CHR$(144);CHR$(255)
```

(Don't worry, that last CHR$(255) will be discussed shortly.)

In line 10, CHR$(18) puts the Printer into Graphics Mode and CHR$(27);CHR$(16) (line 20) tells it to get ready to position the Print Head. (Note that CHR$(0) is necessary.)

Try this line to print a vertical bar at the right-most available dot-column — 1319.

```
10 LPRINT CHR$(27);CHR$(20);CHR$(18);CHR$(27);CHR$(16);
CHR$(5);CHR$(39);CHR$(255);
```

What happens is:

- CHR$(27);CHR$(20) puts the DMP-420 into Condensed character set.
- CHR$(18) puts the Printer into Graphics Mode.
- CHR$(27);CHR$(16) tells the DMP-420 to get ready to position the Print Head.
- CHR$(5) tells the Printer that the position will be greater than 1280.
- CHR$(39) specifies the last available dot-column.

(**Note:** If you used CHR$(40) in this line instead of CHR$(39), the DMP-420 would "wrap-around" to the first dot-column in the next line.)

Printing Graphics Patterns

By now, you should be adept at positioning the Print Head. But you also need to be able to tell the DMP-420 what to print once the Head is positioned.

Remember that we said there were 7 vertical dots in each dot-column. You can print any or all of these dots in any combination you want.

Look back at the sample programs used when we talked about Print Head positioning. Do you remember the last part of the program line (CHR$(255)) which always printed a vertical bar? That's an example of all 7 dots being printed at once.

Try printing just the top dot of that last dot-column (1319):

```
1ØLPRINT CHR$(27);CHR$(2Ø);CHR$(18);CHR$(27);CHR$(16);
CHR$(5);CHR$(39);CHR$(129);
```

How does the CHR$(129) print just the top dot?

Even though the 7 dots in a dot-column are in a vertical row, they are not numbered sequentially down from 1 to 7. Table 21 describes the numbering system you must use with the DMP-420 when specifying an individual dot:

DMP-420 Addressable Dot Numbering System

Dot #:	Dot:	Number You Must Use To Print the Dot:
1	●	129
2	●	130
4	●	132
8	●	136
16	●	144
32	●	160
64	●	192

Table 21

For instance, you've already seen how to print the top dot in the column, but to print the bottom dot, change the program line to:

```
1ØLPRINT CHR$(27);CHR$(2Ø);CHR$(18);CHR$(27);CHR$(16);
CHR$(5);CHR$(39);CHR$(192);
```

This is fine if you want to print an individual dot, but how do you print a combination of dots?

It's actually quite simple too.

1. Specify the Dot # (1-64, see Table 21) that represents the individual dots you want to print.

2. Add those individual Dot #'s together.

3. Add the sum of the combined Dot #'s to 128.

For example, if you want to print the first dot (Dot #1), the fourth dot (Dot #8), and the last dot (Dot #64), add them together: 1 + 8 + 64 = 73. Then add the sum (73) to 128: 73 + 128 = 201. Use 201 as the addressable dot pattern in the form CHR$(201):

```
1Ø LPRINT CHR$(27);CHR$(2Ø);CHR$(18);CHR$(27);CHR$(16);
CHR$(5);CHR$(39);CHR$(2Ø1);
```

Remember how CHR$(255) printed a solid (all dots printed) vertical bar. Try out the formula on that:

(1 + 2 + 4 + 8 + 16 + 32 + 64) = 127 + 128 = 255

The following sample program line will print a box with a line through the middle:

```
1ØLPRINT CHR$(27);CHR$(2Ø);CHR$(18);CHR$(27);CHR$(16);
CHR$(1);CHR$(3Ø);CHR$(255);CHR$(2Ø1);CHR$(2Ø1);CHR$(2Ø1);
CHR$(2Ø1);CHR$(255);
```

Now to flex our muscles.

Type in this NEW program:

```
10 LPRINT CHR$(18)
20 S=1:N=128
30 FOR I=1 TO 20:S=-S
40 FOR J=0 TO 6
80 IF S<0 THEN N=N+2*(6-J) ELSE N=N-2*J
90 LPRINT CHR$(N);
100 NEXT J:NEXT I
120 LPRINT CHR$(30)
```

and RUN it. Be prepared for a pause; it takes time to fill the print buffer.

This program alternately adds and subtracts powers of two to the current code pattern stored in the variable N. The net effect is to add or remove a single dot from the preceding dot pattern.

Line Feed

In Graphics Mode, it is assumed that you want to print rows of graphics one right after another, each 7 dots high. Therefore, Graphics Mode provides only one Line Feed. A single Line Feed advances the paper 7 dots or approximately 0.1 inch. This small paper advance allows for continuous printing without unwanted space between lines.

Modify the current program to demonstrate this fixed Line Feed. Add or change:

```
20 FOR K=1 TO 2:S=1:N=128
50 IF K=1 THEN 80
60 IF S<0 THEN N=N+2*J ELSE N+N-2*(6-J)
70 GOTO 90
110 LPRINT:NEXT K
```

and RUN the program.

These lines infiltrate the current loop and produce a mirror image of the first pass of the Print Head. The LPRINT in line 110 causes the Line Feed between passes.

Repeat Function

CHR$(28) will tell the DMP-420 to repeat a graphic pattern a specified number of times.

The format for the Repeat Function is:

repeat code + number of times to repeat + what to repeat

For instance, LPRINT CHR$(28);CHR$(15);CHR$(255) will print the solid vertical bar 15 times.

Change line 90 to:

```
90 LPRINT CHR$(28);CHR$(2);CHR$(N);
```

and Run the program.

Print Density

Horizontal dot density in Graphics Mode is the same as that of the character width prior to entering Graphics Mode. (If you have been using standard, font style and then enter Graphics Mode resolution will be 480 dots per line; If you have been using compressed characters before entering Graphics Mode, resolution will be 576 dots per line; If you have been using condensed or correspondence or proportional characters, resolution will be 800 dots per line.) Add to the current sample program:

```
5 LPRINT CHR$(27);CHR$(23);``COMPRESSED CHARACTER WIDTH'';
```

and RUN it.

Line 5 activates the Compressed character set. Graphics are then printed in Compressed character density.

Leaving Graphics Mode

CHR$(30) is used to exit Graphics Mode. It places the DMP-420 in the same mode (DP or WP) the Printer was in when it entered Graphics Mode. In addition, all the previous conditions, such as underline and character style, are restored. Change the sample program to:

```
90 LPRINT CHR$(N);
130 LPRINT ``STILL IN COMPRESSED MODE''
```

and RUN it.

Sure enough, the Compressed mode is still alive and well.

Mixing Modes on the Same Line

The fact that character density is unaffected as the DMP-420 moves in and out of Graphics Mode is a blessing when mixing Text and Graphics on the same line. It simplifies the calculation of the number of dots per line.

Freehand Drawing

Having high-resolution graphics at your disposal is great, but you must realize that it requires plenty of data. The Computer can do most of the work in drawing figures that can be described by a mathematical function. Freehand drawings, on the other hand, require translating the figure into a matrix of dots, then calculating the dot printing combinations for each Print Head position. Since there are 7 dots available for graphics, separate the matrix into rows 7 dots high.

The numbers can be stored in DATA statements. To conserve memory and typing time, store the data as numbers from 0 to 127, then add 128 as you send them to the Printer. Enter these sample DATA lines:

```
NEW (ENTER)
120 DATA 999
160 DATA 19,12,112,999
190 DATA 40,39,16,16,8,15,999
210 DATA 16,16,8,8,4,4,2,2,1,1,999
```

The 999's will be used to signify the end of a line. The other numbers are between 0 and 127. Now for the program to read the numbers, add 128, then send them to the Printer.

```
10 LPRINT CHR$(18)
20 FOR R=1 TO 4
30 READ N: IF N=999 THEN 80
40 LPRINT CHR$(128+N);: GOTO 30
80 LPRINT: NEXT R
90 LPRINT CHR$(30)
100 LPRINT ''OMP 420''
```

Now RUN the program.

Not much to brag about yet. Maybe what it needs is to be jazzed up to repeat a number several times. A good approach is to use negative numbers to indicate the number of repetitions followed by the number to be repeated. Add:

```
120 DATA 17,33,33,34,-4,66,68,-4,4,-5,8,-5,16,-5,32,
-5,64,999
130 DATA 64,96,80,72,68,66,97,112,120,124,126,-7,127,-5,126
180 DATA 95,79,71,67,65,32,16,8,4,2,1,0,1,2,4,11,87,75
```

Don't RUN it yet!

In line 120, the sequence -4,66 is used to mean four 66s: 66,66,66,66. You must modify the program to recognize the negative numbers. Change:

```
40 IF N>=0 THEN LPRINT CHR$(128+N);: GOTO 30
50 READ M
60 LPRINT CHR$(28)CHR$(-N)CHR$(128+M);
70 GOTO 30
```

and RUN.

The figure still doesn't look like much. Add the remaining DATA lines and see what you've been working on.

```
110 DATA -7,0,64,64,96,96,80,80,72,72,-2,100,-2,114,57,57
140 DATA -5,124,-2,120,-3,121,-2,113,-3,114,98,98,-2,100
150 DATA -2,116,92,88,72,64,32,32,16,80,104,72,5,101,51
170 DATA 127,-4,64,-5,59,-5,7,-5,15,-5,31,-5,63,-6,127
200 DATA -5,0,-5,1,-5,2,-5,4,-5,8,-5,16,-5,32,-4,
64,127,32,32
```

RUN the program.

Now that's worth the effort!

Appendix A/Control Code Summary

Code Dec.	Code Hex.	Data Processing Mode	Word Processing Mode	Graphics Mode	Remarks
00 01	00 01	Ignored	Ignored	Ignored	
08 n	08	Backspace (n=Binary) n ; Back Spaced Dot number	Backspace (n=Binary) n ; Back Spaced Dot number	Ignored Receives n as character data	***
10 or 138	0A 8A	Executive Line Feed (Execute LF in ac- cordance with information latched)	Full Line Feed (Executive)	11/108" Line Feed (Executive) · · · · 8A hex. 138 dec.	*LF/NL selectable ***
12	0C	Form Feed	Form Feed	Form Feed	LF/NL selectable
13 or 141	0D 8D	Carraige Return (When NL, LF pitch is latched one.)	Carriage Return (When NL, LF pitch is 1/6" per line.)	Carriage Return only 0D Hex. (When NL, LF pitch is 11/108" per line.)	NL/CR, selectable
14	0E	End Underline	End Underline	Ignored	
15	0F	Start Underline	Start Underline	Ignored	
18	12	Select Graphics Mode	Select Graphics Mode	Ignored	**Exchangeable for another code
19	13	Ignored	Select Data Processing Mode	Ignored	
20	14	Select Word Processing Mode	Ignored	Ignored	
27 01~09	1B 01 ~ 09	Proportional Spacing (2nd Byte is dot-column number.)	Proportional Spacing (2nd Byte is dot-column number.)	Ignored	***
27 14	1B 0E	Start Elongation	Start Elongation	Start Elongation	Exchangeable for another code
27 15	1B 0F	End Elongation	End Elongataion	End Elongation	Exchangeable for another code
27, 16 n1, n2	1B, 10 n1, n2	Positioning (3 pitches are available.) (n1, n2 indicate dot position from Home position.)	Positioning (3 pitches are available.) (n1, n2 indicate dot position from Home position.)	Positioning (3 pitches are available.) (n1, n2 indicate dot position from Home position.)	n1, n2: Binary value ***

Code Dec.	Code Hex.	Data Processing Mode	Word Processing Mode	Graphics Mode	Remarks
27 17	1B 11	Select Proportional character	Select Proportional character	Ignored	
27 18	1B 12	Select Correspondence Quality character	Select Correspondence Quality character	Ignored	
27 19	1B 13	Select Standard character	Select Standard character	Ignored	**Exchangeable for another code
27 20	1B 14	Select Condensed character	Select Condensed character	Ignored	**Exchangeable for another code
27 23	1B 17	Select Compressed character	Select Compressed character	Ignored	
27 31	1B 1F	Start Bold	Start Bold	Ignored	
27 32	1B 20	End Bold	End Bold	Ignored	**Exchangeable for another code
27 52, n	1B 34, n	Form Feed set	Form Feed set	Form Feed set	
27 50	1B 32	1/12 Forward Line Feed	1/12 Forward Line Feed	1/12 Forward Line Feed	
27 51	1B 33	1/36 Forward Line Feed	1/36 Forward Line Feed	1/36 Forward Line Feed	
27 10	1B 0A	Set Full Reverse Line Feed (No motion)	*Full Reverse Line Feed (Executive)	Ignored	
27 28	1B 1C	Set Half Forward Line Feed (No motion)	*Half Forward Line Feed (Executive)	Ignored	
27 30	1B 1E	Set Half Reverse Line Feed (No motion)	*Half Reverse Line Feed (Executive)	Ignored	**Exchangeable for another code
27 54	1B 36	Set Full Forward Line Feed (No motion)	Ignored	Ignored	
27 56	1B 38	Set 3/4 Forward Line Feed (No motion)	*3/4 Forward Line Feed (Excutive)	Ignored	
28 n1, n2	1C n1, n2	Repeat Print Data (Undefined Code is change to " X .")	Repeat Print Data (Undefined Code is changed to " X ."	Repeat Print Data (IF MSB=0, Data is ignored.)	

Code Dec.	Code Hex.	Data Processing Mode	Word Processing Mode	Graphics Mode	Remarks
30	1E	Ignored	Ignored	End Graphics Mode	Exchangeable for another code
127	7F	Ignored	Ignored	Ignored	
255	FF	Ignored	Ignored	(Printing Data)	
Other Codes in Function Area (02 to 1F hex.)		Prints "X."	Prints "X."	Ignored	
Other Codes in Function Area (80 to 9F hex.)		Prints "X."	Prints "X."	(Printing Data)	

Note: * If Function Selection Switch 6 is set to OPEN, one Line Feed operation is performed at the same time.

*** These codes may not be able to be sent to the Printer by your Computer. In this case, use system commands to send them.

New DMP-420 Command Codes

If Switch #1 is set to OFF [▢], then the following codes are used:

Operation	Use CHR$( ) Code:
Start Graphics Mode	18
End Graphics Mode	30
Start Elongation	27 14
End Elongation	27 15
Standard Character	27 19
Condensed Character	27 20
End Bold Character	27 32
Half Reverse Line Feed	27 30

Line Printer VI Command Codes

If Switch #1 is set to ON [▢], then these codes are used:

Operation	Use CHR$( ) Code:
Start Graphics Mode	27 19
End Graphics Mode	27 20
Start Elongation	31
End Elongation	30
Standard Character	27 15
Condensed Character	27 14
End Bold Character	27 30
Half Reverse Line Feed	27 32

Appendix B/Interface

Parallel Interface

Interface Connector

Type --------------------------------- 36-Pin Receptacle
Model ---------------------------- 552742-1 or equivalent

Manufacturer ---------------------- AMP or equivalent

Pin Assignment
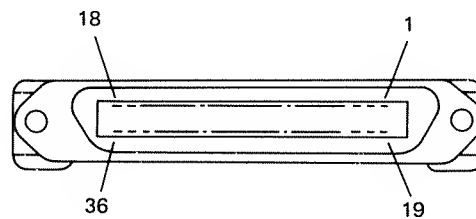
Signals

Signal Pin	Name of Signals	Signal Pin	Name of Signals
1	$\overline{\text{STROBE}}$	19	0 V (Return for 1)
2	DATA 1	20	0 V (Return for 2)
3	DATA 2	21	0 V (Return for 3)
4	DATA 3	22	0 V (Return for 4)
5	DATA 4	23	0 V (Return for 5)
6	DATA 5	24	0 V (Return for 6)
7	DATA 6	25	0 V (Return for 7)
8	DATA 7	26	0 V (Return for 8)
9	DATA 8	27	0 V (Return for 9)
10	$\overline{\text{ACK}}$	28	0 V
11	BUSY	29	0 V
12	PE (Paper Out)	30	0 V
13	$\overline{\text{BUSY}}$	31	NC (Not Connected)
14	0 V	32	$\overline{\text{FAULT}}$ (Printer Error Condition)
15	NC (Not connected)	33	NC (Not Connected)
16	0 V	34	NC (Not Connected)
17	CHASSIS GROUND	35	NC (Not Connected)
18	+5 V (80 mA Maximum)	36	NC (Not Connected)

Parallel Interface Signals
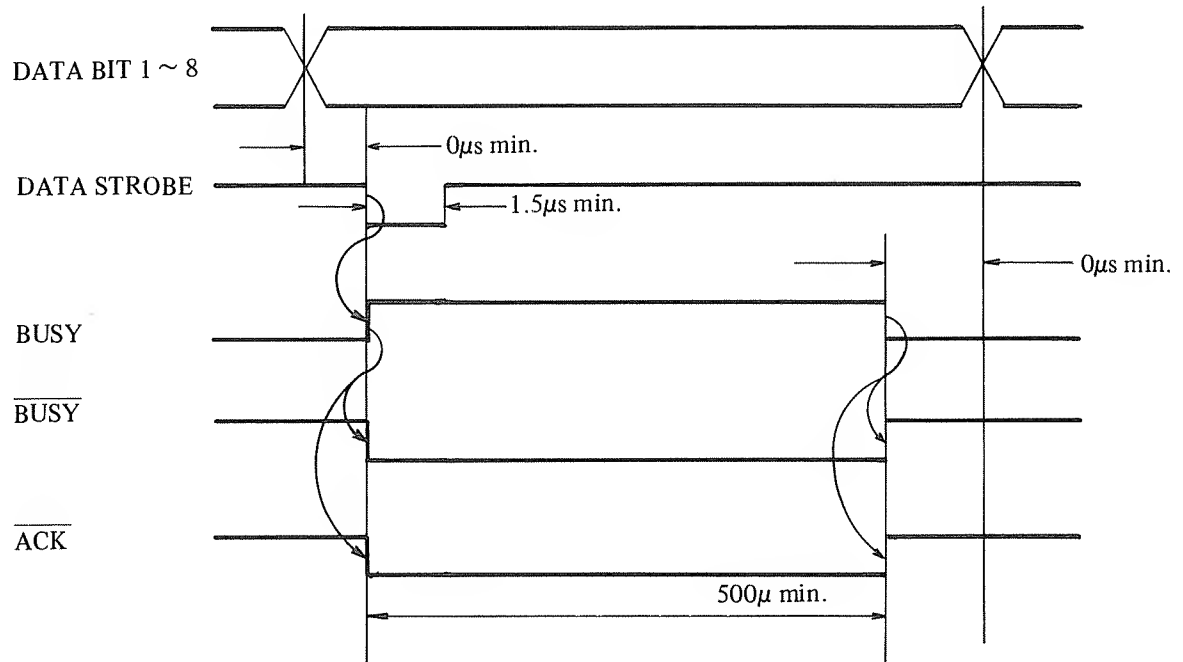
Timing Diagram

DB1–DB8– Host Generated
Data Bits DB1–DB8 contain ASCII character data information. Data bit levels are
positive true logic.

$\overline{\text{ACKNOWLEDGE}}$– Printer Generated
The $\overline{\text{ACK}}$ signal is a negative-going signal which indicates, by the rising edge, that the
Printer is no longer busy.

BUSY– Printer Generated
The BUSY signal goes positive to indicate when the Printer cannot accept new data from
the Host, or some Fault condition has occurred. Timing is illustrated in the Timing
Diagram.

PAPER OUT (PE)– Printer Generated
The paper out signal is a positive-going pulse which indicates that the Printer is out of
paper or that the Printer is not ready to receive data.

$\overline{\text{BUSY}}$– Printer Generated
The BUSY signal is the logical inverse of BUSY.

$\overline{\text{FAULT}}$– Printer Generated
The FAULT line is a negative-going signal that indicates there is a fault condition present;
i.e., paper out, logic fault, off-line condition, or other mechanical fault.

$\overline{\text{STROBE}}$— Host Generated
The $\overline{\text{STROBE}}$ signal is a negative-going signal which indicates, by the rising edge, that the Host sends data to the Printer.

CHASSIS GROUND
This line is connected to the chassis of the Printer.

5V— Printer Generated
This line is connected to the Printer's Logic +5V Line.
Maximum supply current is 80mA.

Parallel Interface Receivers and Drivers

All I/O Signals are TTL compatible

Receiver

8mA max.
when low

+5V

To Printer

Driver

+5V

16mA min.
when low

Open Collector
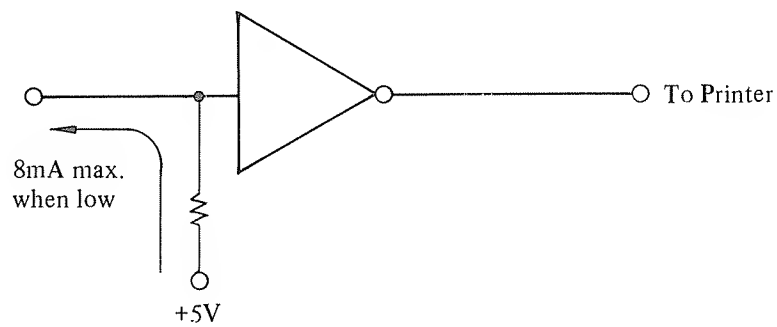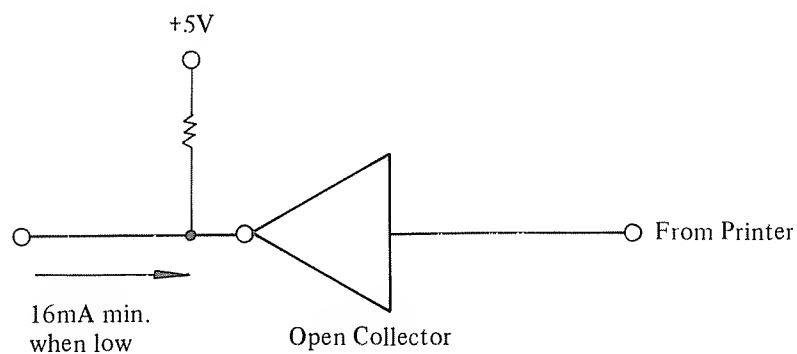
From Printer

Note: Printer generated signals, "BUSY", "$\overline{\text{FAULT}}$", "PE", "$\overline{\text{BUSY}}$, and "$\overline{\text{ACK}}$," have a 2.2 kohm pull-up resistor.

51

Serial Interface

Serial Interface is selected by setting Function Selection Switch 3 to CLOSE.

Transmission Rate is selected from two rates (600 BPS and 1200 BPS) by Function Selection Switch 2; OPEN designates 1200 BPS and CLOSE designates 600 BPS.

Function Selection Switch 2 is activated only in a Serial Interface condition.

General Specifications of Serial Interface

Standard	Meet with RS-232C Serial
Baud Rate	600 or 1200 BPS Serial
Parity	Non-parity
Buffer	Up to 1800 characters
Data Bit	8
Start Bit	1 Space bit
Stop Bit	1 or 2 Mark bit
Signal Cable	15m Max.

Interface Connector and Signals

Type	4-pin Din Jack (Receptacle)
Model	TCS 4640-01A or equivalent
Manufacturer	HOSHIDEN CO., LTD or equivalent

Pin Assignment and Signals.
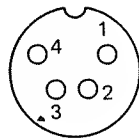
Pin No.	Signal
1	NC
2	$\overline{\text{BUSY}}$
3	GND (0V)
4	$\overline{\text{DATA}}$

$\overline{\text{DATA}}$— To Printer
Signals on this circuit are generated by the Computer for transmission of data to the Printer.

$\overline{\text{BUSY}}$— From Printer
This signal indicates to the Computer whether or not the Printer can accept data. The "off" condition (low) indicates that the Printer is BUSY and cannot accept any more data.

Interface Timing and Signal Level
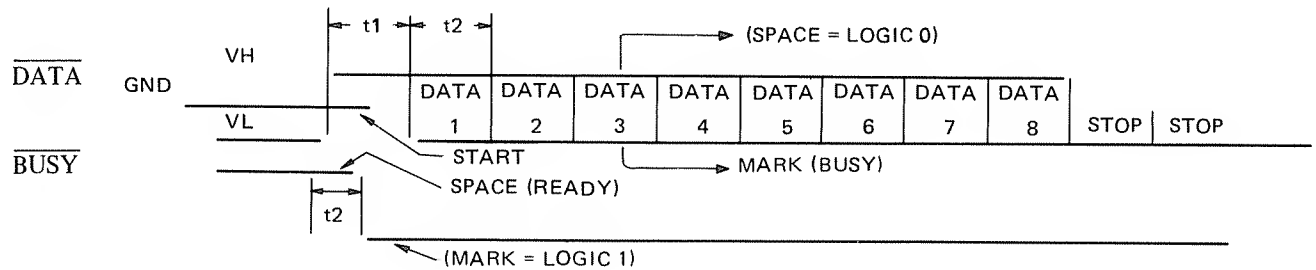
$$+ 3V \leq V_H \leq +25V \qquad \text{(SPACE)}$$

$$-25V \leq V_L \leq -3V \qquad \text{(MARK)}$$

Baud Rate	t1	t2
600 BPS	1.67 msec.	0.83 msec.
1200 BPS	0.83 msec.	0.42 msec.

Remarks on Serial Interfacing Conditions

· When a Framing ERROR is detected, the Printer will print only one "X" data, then stop printing until the data line goes to "V_L" level. In Bit Image Mode, this "X" data is unprintable code, so no printing will be performed.

· The Printer checks only the first stop-bit and ignores the second stop-bit when a two stop-bit condition exists.

· When a string of data is transmitted to the Printer in Serial Interfacing Mode, if each item of data is transmitted intermittently (every one second or more), no printing will be performed until the Printer is in a start printing condition.

Appendix C/Character Sets

The DMP-420 has 349 dot-matrix patterns in the ROM (Read Only Memory). The following is a table of the Character Codes.

The printable characters may be classified as follows.

- Proportional or
  Proportional Elongated
- Correspondence Quality or
  Correspondence Quality Elongated
- Condensed or
  Condensed Elongated

ASCII + Modified ASCII . . . . 94 + 5
European Symbol 32

- Compressed or
  Compressed Elongated
- Standard or
  Standard Elongated

ASCII + Modified ASCII . . . . 94 + 5
European Symbol . . . . 25 Selectable
Japanese Kana 64
Block Graphic 30

94 (+5) ASCII Code

ASCII Character Sets

Code			Char.	Code			Char.	Code			Char.
Dec.	Hex	Oct.		Dec.	Hex	Oct.		Dec.	Hex	Oct.	
32	20	40	(Space)	64	40	100	@	96	60	140	`
33	21	41	!	65	41	101	A	97	61	141	a
34	22	42	"	66	42	102	B	98	62	142	b
35	23	43	#	67	43	103	C	99	63	143	c
36	24	44	$	68	44	104	D	100	64	144	d
37	25	45	%	69	45	105	E	101	65	145	e
38	26	46	&	70	46	106	F	102	66	146	f
39	27	47	'	71	47	107	G	103	67	147	g
40	28	50	(	72	48	110	H	104	68	150	h
41	29	51	)	73	49	111	I	105	69	151	i
42	2A	52	*	74	4A	112	J	106	6A	152	j
43	2B	53	+	75	4B	113	K	107	6B	153	k
44	2C	54	,	76	4C	114	L	108	6C	154	l
45	2D	55	—	77	4D	115	M	109	6D	155	m
46	2E	56	.	78	4E	116	N	110	6E	156	n
47	2F	57	/	79	4F	117	O	111	6F	157	o
48	30	60	0	80	50	120	P	112	70	160	p
49	31	61	1	81	51	121	Q	113	71	161	q
50	32	62	2	82	52	122	R	114	72	162	r
51	33	63	3	83	53	123	S	115	73	163	s
52	34	64	4	84	54	124	T	116	74	164	t
53	35	65	5	85	55	125	U	117	75	165	u
54	36	66	6	86	56	126	V	118	76	166	v
55	37	67	7	87	57	127	W	119	77	167	w
56	38	70	8	88	58	130	X	120	78	170	x
57	39	71	9	89	59	131	Y	121	79	171	y
58	3A	72	:	90	5A	132	Z	122	7A	172	z
59	3B	73	;	91	5B	133	[(↑)	123	7B	173	{
60	3C	74	<	92	5C	134	\ (↓)	124	7C	174	|
61	3D	75	=	93	5D	135	] (←)	125	7D	175	}
62	3E	76	>	94	5E	136	∧ (→)	126	7E	176	~
63	3F	77	?	95	5F	137	— (—)				

Note: 1 Codes 5B Hex (91 Dec) through 5F Hex (95 Dec) can be changed to the characters within parentheses by setting the Function Selection Switch 7 to CLOSE (opposite OPEN).

Note: 2 Following characters are descended by one dot. Small Letter; g,p,q,y,j, (Underline)

32 European Symbol Code

Standard, Compressed or Condensed Character Set

Code			Char.
Dec.	Hex	Oct.	
160	A0	240	(Blank)
161	A1	241	à
162	A2	242	ç
163	A3	243	£
164	A4	244	(Blank)
165	A5	245	μ
166	A6	246	°
167	A7	247	▼
168	A8	250	†
169	A9	251	§
170	AA	252	(Blank)
171	AB	253	©
172	AC	254	¼
173	AD	255	(Blank)
174	AE	256	½
175	AF	257	¶
176	BO	260	¥
177	B1	261	Ä
178	B2	262	Ö
179	B3	263	Ü
180	B4	264	¢
181	B5	265	(Blank)
182	B6	266	ã
183	B7	267	ö
184	B8	270	ü
185	B9	271	β
186	BA	272	(Blank)
187	BB	273	é
188	BC	274	ù
189	BD	275	è
190	BE	276	(Blank)
191	BF	277	ƒ

Proportional Correspondence Quality Character Set

Code			Char.
Dec.	Hex	Oct.	
160	A0	240	/
161	A1	241	à
162	A2	242	ç
163	A3	243	£
164	A4	244	`
165	A5	245	μ
166	A6	246	°
167	A7	247	▼
168	A8	250	†
169	A9	251	§
170	AA	252	®
171	AB	253	©
172	AC	254	¼
173	AD	255	¾
174	AE	256	½
175	AF	257	¶
176	B0	260	¥
177	B1	261	Ä
178	B2	262	Ö
179	B3	263	Ü
180	B4	264	¢
181	B5	265	~
182	B6	266	ä
183	B7	267	ö
184	B8	270	ü
185	B9	271	β
186	BA	272	TM
187	BB	273	é
188	BC	274	ù
189	BD	275	è
190	BE	276	¨
191	BF	277	ƒ

Note: 1 The "optimizer function" allows the following: If a spacing code (fixed space and/or proportional space) is received, the Carriage moves only the shortest distance, and the action will take place without unnecessary movement. This saves printing time. When the character data (SP, proportional space or printable code) are sent to the Printer within a 1-second interval, the Printer automatically stores them until: (1) Function codes are sent, (2) the interval is greater than 1 second. The printing is then executed. If a blank code (in the left table) is received under a Standard, Compressed or Condensed character set condition, the Carriage will move in the same manner as when receiving a printable character. When printing, the use of blank code can be very convenient, and attractive/useful printouts can be produced.

2 The number of dots comprising the following characters are reduced by one dot.
ç, μ, §, β, ƒ

30 Block Graphic Code

Standard, Compressed or Condensed

Code			Char.	Code			Char.
Dec.	Hex	Oct.		Dec.	Hex	Oct.	
224	E0	340	(Blank)	240	F0	360	⌐
225	E1	341	▫	241	F1	361	—
226	E2	342	▫	242	F2	362	┐
227	E3	343	▫	243	F3	363	┬
228	E4	344	▫	244	F4	364	├
229	E5	345	▪	245	F5	365	I
230	E6	346	▪	246	F6	366	L
231	E7	347	▪	247	F7	367	┘
232	E8	250	▪	248	F8	370	┴
233	E9	351	▮	249	F9	371	┤
234	EA	352	▮	250	FA	372	+
235	EB	353	▟	251	FB	373	◤
236	EC	354	▙	252	FC	374	◢
237	ED	355	▜	253	FD	375	◣
238	EE	356	▛	254	FE	376	◥
239	EF	357	▆				

Note: 1   When a Proportional or Correspondence Quality character set condition is selected, these characters will be changed to " X " (invalid code).

     2   These characters are composed of six vertical dots. When using these codes to prepare diagrams, Line Feed should be set to "Half Forward Line Feed." If another paper feed pitch is used, the diagram will not be accurate.

Proportional or Correspondence Quality Character Set

Proportional or Correspondence Quality characters are selected by using ESC DC1 or ESC DC2 Control Code sequence. The characters are composed of an n x 9 dot-matrix. These widths (n) vary from 10 dot-columns to 20 dot-columns. Since all proportional numerals are composed of the same number of dots on the horizontal axis (16 dot-columns), tabulation of numbers are aligned vertically.

● Proportional Character Code Table

The following table lists all printable Proportional or Correspondence Quality characters:

Dec.	Hex	Oct.	Char.	Width	Dec.	Hex	Oct.	Char.	Width	Dec.	Hex	Oct.	Char.	Width	Dec.	Hex	Oct.	Char.	Width
32	20	40	(Space)	08	64	40	100	@	13	96	60	140	`	13	160	A0	240	ℱ	13
33	21	41	!	05	65	41	101	A	15	97	61	141	a	13	161	A1	241	à	13
34	22	42	"	07	66	42	102	B	13	98	62	142	b	11	162	A2	242	ç	11
35	23	43	#	15	67	43	103	C	13	99	63	143	c	11	163	A3	243	£	15
36	24	44	$	13	68	44	104	D	15	100	64	144	d	11	164	A4	244	\	13
37	25	45	%	15	69	45	105	E	13	101	65	145	e	11	165	A5	245	μ	15
38	26	46	&	13	70	46	106	F	13	102	66	146	f	09	166	A6	246	°	07
39	27	47	'	05	71	47	107	G	15	103	67	147	g	11	167	A7	247	▼	05
40	28	50	(	05	72	48	110	H	15	104	68	150	h	11	168	A8	250	†	11
41	29	51	)	05	73	49	111	I	07	105	69	151	i	05	169	A9	251	§	13
42	2A	52	*	11	74	4A	112	J	13	106	6A	152	j	05	170	AA	252	®	15
43	2B	53	+	11	75	4B	113	K	13	107	6B	153	k	11	171	AB	253	©	15
44	2C	54	,	05	76	4C	114	L	13	108	6C	154	l	05	172	AC	254	¼	15
45	2D	55	—	11	77	4D	115	M	15	109	6D	155	m	15	173	AD	255	¾	15
46	2E	56	.	05	78	4E	116	N	13	110	6E	156	n	11	174	AE	256	½	15
47	2F	57	/	11	79	4F	117	O	15	111	6F	157	o	11	175	AF	257	¶	11
48	30	60	0	11	80	50	120	P	13	112	70	160	p	11	176	B0	260	¥	15
49	31	61	1	11	81	51	121	Q	13	113	71	161	q	11	177	B1	261	Ä	15
50	32	62	2	11	82	52	122	R	13	114	72	162	r	09	178	B2	262	Ö	15
51	33	63	3	11	83	53	123	S	13	115	73	163	s	11	179	B3	263	Ü	15
52	34	64	4	11	84	54	124	T	15	116	74	164	t	09	180	B4	264	¢	13
53	35	65	5	11	85	55	125	U	13	117	75	165	u	11	181	B5	265	~	11
54	36	66	6	11	86	56	126	V	13	118	76	166	v	11	182	B6	266	ä	13
55	37	67	7	11	87	57	127	W	15	119	77	167	w	15	183	B7	267	ö	11
56	38	70	8	11	88	58	130	X	13	120	78	170	x	11	184	B8	270	ü	11
57	39	71	9	11	89	59	131	Y	13	121	79	171	y	11	185	B9	271	β	15
58	3A	72	:	05	90	5A	132	Z	11	122	7A	172	z	09	186	BA	272	TM	15
59	3B	73	;	05	91	5B	133	[(↑)	09(11)	123	7B	173	{	09	187	BB	273	é	11
60	3C	74	<	09	92	5C	134	\ (↓)	11(11)	124	7C	174	¦	05	188	BC	274	ù	11
61	3D	75	=	11	93	5D	135	] (←)	09(15)	125	7D	175	}	09	189	BD	275	è	11
62	3E	76	>	09	94	5E	136	∧ (→)	13(15)	126	7E	176	~	11	190	BE	276	¨	11
63	3F	77	?	11	95	5F	137	— (—)	13(11)					18	191	BF	277	ƒ	11

Note: The number in the "width" column indicates the dot size of each character.

● Proportional Character Set — Dots Per Column

10 DOTS		12 DOTS		14 DOTS	
Space	—32/20	" —	34/22	< —	60/3C
!	—33/21	| —	73/49	> —	62/3E
acute	—39/27	o —	166/A6	f —	102/66
(	—40/28			r —	114/72
)	—41/29			t —	116/74
.	—46/2E			z —	122/7A
:	—58/3A			{ —	123/7B
;	—59/3B			} —	125/7D
`	—96/60				
i	—105/69				
j	—106/6A				
1	—108/6A				
¦	—124/7C				
▼	—167/A7				

16 DOTS

*	—42/2A	e —	101/65	
+	—43/2B	g —	103/67	
–	—45/2D	h —	104/68	
/	—47/2F	k —	107/6B	
0	—48/30	n —	110/6E	
1	—49/31	o —	111/6F	
2	—50/32	p —	112/70	
3	—51/33	q —	113/71	
4	—52/34	s —	115/73	
5	—53/35	u —	117/75	
6	—54/36	v —	118/76	
7	—55/37	x —	120/78	
8	—56/38	y —	121/79	
9	—57/39	~ —	126/7E	
=	—61/3D	ç —	162/A2	
?	—63/3F	+ —	168/A8	
Z	—90/5A	¶ —	175/AF	
[	—91/5B	~ —	181/B5	
↑	—91/5B(TANDY)	ö —	183/B7	
\	—92/5C	ü —	184/B8	
↓	—92/5C(TANDY)	é —	187/BB	
]	—93/5D	ù —	188/BC	
Underline(2)	—95/5F(TANDY)	è —	189/BD	
b	—98/62	¨ —	190/BE	
c	—99/63	ƒ —	191/BF	
d	—100/64			

18 DOTS

#	—35/23	R —	82/52
$	—36/24	S —	83/53
&	—38/26	U —	85/55
@	—64/40	V —	86/56
B	—66/42	X —	88/58
C	—67/43	Y —	89/59
E	—69/45	∧ —	94/5E
F	—70/46	a —	97/61
J	—74/4A	´ —	160/A0
K	—75/4B	à —	161/A1
L	—76/4C	` —	164/A4
N	—78/4E	§ —	169/A9
P	—80/50	¢ —	180/B4
Q	—81/51	ä —	182/B6

20 DOTS

%	—37/25	£ —	163/A3
A	—65/41	µ —	165/A5
D	—68/44	® —	170/AA
G	—71/47	© —	171/AB
H	—72/48	¼ —	172/AC
M	—77/4D	¾ —	173/AD
O	—79/4F	½ —	174/AE
T	—84/54	¥ —	176/B0
W	—87/57	Ä —	177/B1
←	—93/5D(TANDY)	Ö —	178/B2
→	—94/5E(TANDY)	Ü —	179/B3
Underline(1)	—95/5F	β —	185/B9
m	—109/6D	Tм—	186/BA
w	—119/77		

Appendix D/Programming Information

The following items should be considered when you program the Computer.

1. When Printer Power is turned on:

   - Optional functions are selected via the Function Selection Switches.
   - If Data Processing Mode is selected, Full Forward Line Feed is set.
   - One of five character styles is selected via the Rotary Switch position.
   - Underline is not set.
   - Normal character is sct (not Elongated and not Bold).
   - Buffer memory is completely cleared.

2. Every character font can be intermixed with another style of character in the same line. However, the Printer will insert dot spaces to insure that the new dot position is valid for the current character size. This may cause unexpected auto-wraparound. To prevent this, intermix characters only on short lines, or don't mix character sizes on the same line.

3. Since a proportional spacing command may be used in any character set condition, right-justification can be performed. You must consider that Proportional spacing commands can indicate up to 9-dot spacing, while using Standard, (10 or 5 CPI) Compressed (12 or 6 CPI), or Condensed (16.7 or 8.3 CPI) characters — therefore, a normal space 20 Hex (32 Dec) — gives 12 or 24 dot spaces.

4. Elongated (Double-width) characters and Underline are not terminated at the end of the line and printing continues until a terminating command is received.

5. You should avoid wrap-around. Wrap-around will disturb the dot count of the text in a line.

6. Backspace is performed in the same manner under any character set condition. This command indicates the number of dots to backspace.

7. If Block Graphic Character Codes (EO Hex through FE Hex — 224 Dec through 254 Dec) are accessed in Proportional character mode, these codes will be converted to an invalid code (X).

8. In the Repeat Data commands, printable characters can be repeated as many times as provided for in the count number. If any function code is received for repetition, it will be considered an invalid symbol (X).

9. POS commands can be used at any carriage position. If a designated dot-column address is in the current text which is already printed out, overprint will occur.

10. Under block graphic printing, Half Forward Line Feed should be used for printing diagrams.

11. Line Feed in Graphics Mode is different from Line Feed pitches in Data Processing or Word Processing Mode. It will generate an odd vertical spacing in Graphics Mode, while the other modes intermix in a form. Consider the following relationship between Line Feed pitches.

    11 times of Full Line Feed = 18 times of Graphics Line Feed
    11 times of Half Line Feed = 9 times of Graphics Line Feed

12. Graphic printing can be intermixed with character printing in the same line. Dot density in Graphics Mode is the same as the density of the former character style.

13. Bold character mode is useful for headings or titles.

Programming Examples

Note to Model II Programmers:

If the Printer goes off-line during a print operation, and remains off-line for a certain period of time, Model II TRSDOS will present an error message. Application programs should be written to trap such errors, inform the operator of the error condition, and give the operator a chance to correct the condition and continue printing. If it is a BASIC applications program, an I/O error will occur and the operator may type CONT [ENTER] to continue.

The BASIC statements LPRINT and LLIST output to the Line Printer. See your Computer's reference manual for syntax details. If you have a Color Computer, read all "LPRINT" as "PRINT # − 2,".

Examples:

LLIST
> Lists the resident program to the Printer.

LPRINT "THIS IS A TEST"
> Prints the message in quotes and tells the Printer that the next printable character brings a new line.

LPRINT "THIS IS PART OF A LINE";:LPRINT "THIS IS THE REST"
> Prints both messages on the same line (because of the semicolon).
> The next printable character received starts a new line.

LPRINT "SMALL"; CHR$(27); CHR$(14); "LARGE"; CHR$(27); CHR$(15); "SMALL AGAIN"
> Prints both normal and elongated characters on the same line.

LPRINT CHR$(27); CHR$(17); "PROPORTIONAL"; CHR$(27); CHR$(18); "CORRESPONDENCE"; CHR$(27); CHR$(20); "CONDENSED"; CHR$(27); CHR$(23); "COMPRESSED"; CHR$(27); CHR$(19); "STANDARD"
> Prints proportional, correspondence, condensed, compressed, and standard characters in the same line.

LPRINT"X"; CHR$(20); CHR$(27); CHR$(30); "2"; CHR$(27); CHR$(28); "+ X = Y"
> Prints an algebraic function expression $X^2 + X = Y$.

LPRINT "H"; CHR$(27); CHR$(28); "2" CHR$(27); CHR$(30); "0"
> Prints the formula of water H_2O.

LPRINT CHR$(19); "START"; CHR$(27); CHR$(56); CHR$(138); "ONE LINE"; CHR$(138); "TWO LINE"
> Prints these letters at ¾ line pitch.

LPRINT CHR$(15); "UNDERLINE"; CHR$(14); "WITHOUT UNDERLINE"
> Prints both messages underlined and non-underlined in the same line.

LPRINT CHR$(27); CHR$(31)' "BOLD LETTERS"; CHR$(27); CHR$(32); "NORMAL LETTERS"
> Prints Bold letters and Normal letters in the same line.

LPRINT CHR$(28); CHR$(9); "ABC"
> Prints 9 characters of "A" and one character "BC"

LPRINT CHR$(13); CHR$(27); CHR$(16); CHR$(01); CHR$(44); "300TH POSITION"
> Prints above message from 300th column address.

LPRINT CHR$(27); CHR$(17); "A"; CHR$(27); CHR$(09); "B"; CHR$(27); CHR$(06); "C"; CHR$(27); CHR$(03); "DE"
> Prints ABCDE by using Proportional spacing.

LPRINT CHR$(18); CHR$(255); CHR$(247); CHR$(227); CHR$(193); CHR$(227); CHR$(247); CHR$(255); CHR$(30)
> Prints a special symbol in Graphics Mode.

LPRINT "DELETE"; CHR$(08); CHR$(72); "//////"
> Prints the message DELETE; then it is deleted by diagonal lines.

Appendix E/Care and Maintenance

1. Always plug the Printer into a 3-wire grounded receptacle.

2. Be sure that the Top Cover is closed and secured while in operation.

3. Never operate the Printer without paper. If paper used is less than 4" wide, take care to see that printing does not exceed paper width.

4. Avoid leaning objects against the Printer or placing anything on top. If any object is accidentally dropped into the machine, turn power off and carefully remove the object.

5. Be sure to turn power off before adjusting the penetration of the Print Head or replacing ribbon.
   Note: When you turn power off, all data stored in the Printer's buffer will be lost; keep this in mind as you perform routine maintenance. Remember that toggling the Printer's power can also cause erratic operation of the CPU.

6. Use only lint-free cloth to clean the Printer surface. Do not use solvents or harsh cleaning agents. Mild detergent solution or desk top cleanser may be used sparingly.

7. Keep hands away from the Carriage mechanism while the Printer is in operation. Since the Carriage moves with considerable force, inserting your hand would be extremely hazardous.

8. The Printer must be kept dry. If water is accidentally spilled on the machine, turn power OFF immediately and wipe dry. Do not turn power ON until completely dry.

9. If printed material is too light or too dark, check to see if the Print Head is adjusted properly. See the section entitled "Fanfold Paper Loading" for specific details on adjusting the Print Head.

Care

- Do not use organic solvents or alcohol when cleaning the cover.
- Never operate the Printer when the Top Cover is open.
- Never set the Printer where it is exposed to direct sunlight.
- Prevent the Printer from vibrating during operation.
- Graphics printing places a heavier load on the Print Head than do text characters. If you print too many block graphic characters or bit images without pausing, the Print Head could overheat, causing the fuse to blow.

  When you must print graphics continuously, be sure to pause the printing for at least one minute after each 1/6th paper is printed (assuming a 15" x 11" page). This will prevent the unit from overheating. In terms of load on the Print Head, the underline falls into the graphics category, and should be treated as such.

Maintenance

- If the Print Head becomes clogged with ribbon material or paper lint, carefully remove such material with a finely pointed tool (preferably a toothpick). This should be regularly checked.
- A Print Head's life expectancy is approximately 2000 hours (in other words, if you use the Printer two hours a day on the average, the Print Head should be changed every 32 months). When poor print quality, sticking ribbon, or bent character printing occurs, you should have the Print Head replaced by a Radio Shack service technician.

- After cleaning with a soft cloth, lightly oil the two carriage guides with a high-grade ester lubricating oil or with high-grade sewing machine oil. (This should be done at least every six months.) Lubricate the platen removing shaft, the left wire pulley shaft, the right wire pulley shaft, the ribbon feed revolving shaft, and the gear revolving shaft, using molybdenum disulfide compound or another high-grade lubricating grease.

- Because ink from the paper can get on the Paper Bail rollers, we suggest a periodic cleaning of the rollers. Use 90% isopropyl alcohol to remove ink build up on the rollers as often as necessary.

If You Have Problems . . .

If the Printer fails to operate properly, try to solve the trouble by using the following table.

SYMPTOM	INSPECTION and ADJUSTMENT
Printer does not operate when POWER switch is turned ON. Printer stops before paper runs out.	● Is power cord properly connected? ● Is power source voltage too low? Printer should stop if below 90% of rated voltage. ● If you cannot hear any sound or see any movement, remove the Top Cover and check the fuses. (Even if the driver power fuse is broken, the indicator on the control panel will be lit when power is ON.)
Printer stops with ALERT indicator lit.	● Is paper loaded properly? ● Is carriage guide dirty? If so, clean it by using a soft cloth and lubricate it with a high-grade ester lubricating oil or high-grade sewing machine oil. ● Has some object dropped inside the Printer? ● If nothing is wrong, turn power OFF, then ON.
Ribbon fails to track properly.	● Is ribbon cassette properly set? ● Has ribbon come off from the print head ribbon guide and is loose? ● Is ribbon so worn that it does not feed smoothly from the cassette? ● Has the Print Head reached its life expectancy? A worn out head will stick to ribbon and interfere with smooth movement. Replace the Print Head with a new one.
Poor print quality or smudging on paper.	● Is ribbon old and/or worn? ● Is the Print Head Control Lever set at the proper position? ● Is the tip of the Print Head dirty? If dirty, clean it off with a toothpick or needle.
Erratic operation or wrong character printing.	● Is the interface cable and/or connector damaged? ● Are interface connectors inserted properly to the Computer or to the Printer?
The paper cannot be advanced smoothly.	● Is paper loaded properly into the entrance of the insertion opening? ● Is any obstacle preventing smooth paper motion ? ● Does paper stick or tear because of the side guide pins?

If the trouble cannot be corrected after making the above check-up and adjustment, check for secure contacts of all connectors. If you can't eliminate the problem, take the unit to your Radio Shack Store or Computer Center for repair. We'll have it back to you ASAP!

Printing Limits (Duty Cycle)

The DMP-420 does have its limits when it comes to heavy, continuous printing. Depending upon the type of printing being performed, those limits vary.

DMP-420 Printing Limits				
Type of Printing		%		Number of Pages
Character	at	100%	for	8
		70%		30
		50%		continuous
Bit Image		100%		1/2
		70%		1-1/2
		50%		15
Block Graphics		100%		1/3
		70%		2/3
		50%		1-1/3

Note: These figures are based on a 132-column printing width. 100% printing would mean every column is printed; 50% printing means that every other column is printed.

Appendix F/Schematic Diagram

26-1267 CIRCUIT DIAGRAM
(REVISED ON May 1, 1983)
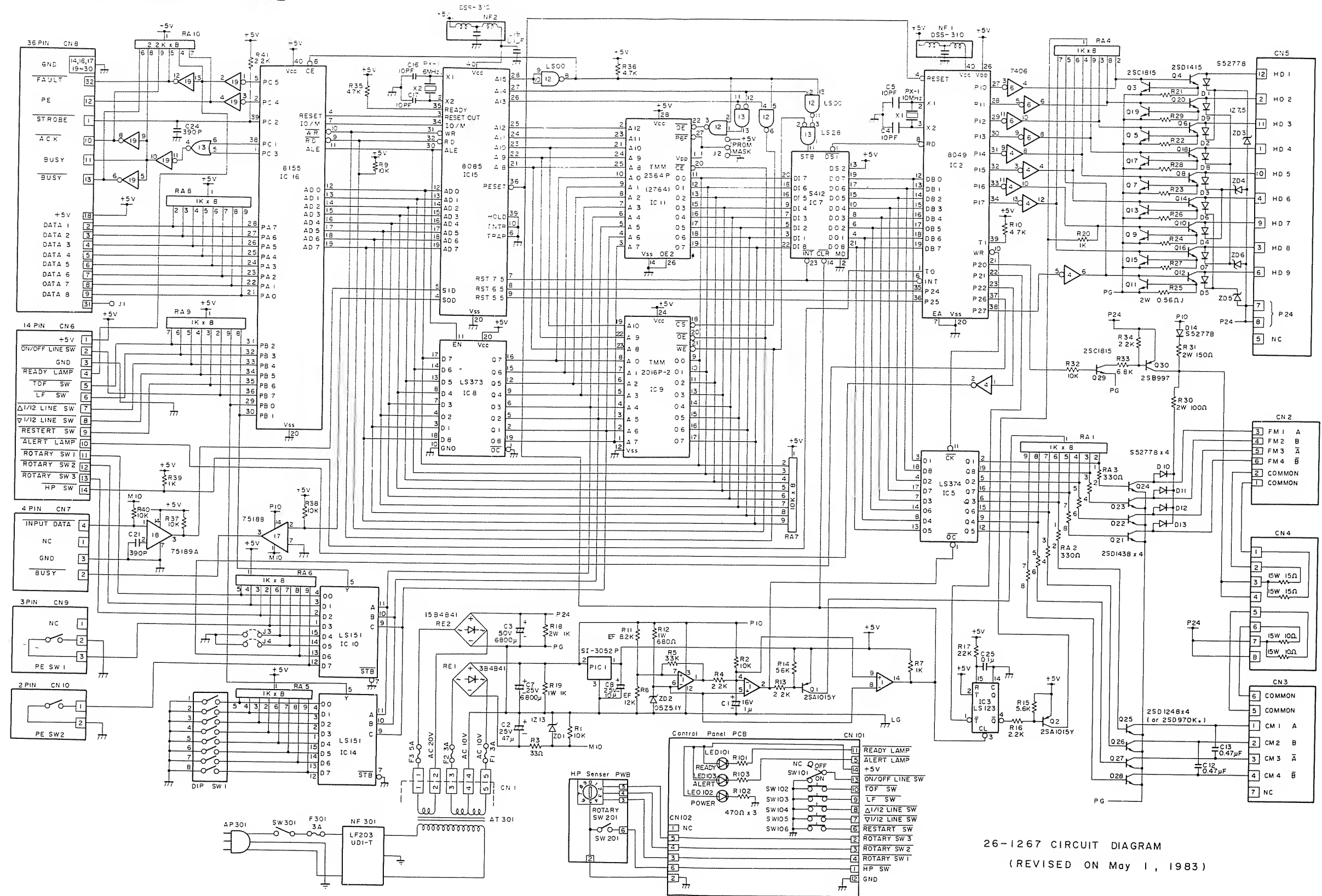
Appendix G/Specifications

Printing speed (characters per second)
- Correspondence Quality 10 CPI 84
- Elongated Correspondence Quality 5 CPI 42
- Proportional 98
- Elongated Proportional 49
- Condensed 16.7 CPI 140
- Elongated Condensed 8.3 CPI 70
- Standard 10 CPI 140
- Elongated Standard 5 CPI 70
- Compressed 12 CPI 140
- Elongated Compressed 6 CPI 70

Characters Per Line
- Correspondence Quality 10 CPI 132
- Elongated Correspondence Quality 5 CPI 66
- Proportional .... 132 to 264
- Elongated Proportional .... 66 to 132
- Condensed 16.7 CPI 220
- Elongated Condensed 8.3 CPI 110
- Standard 10 CPI 132
- Elongated Standard 5 CPI 66
- Compressed 12 CPI 158
- Elongated Compressed 6 CPI 74

Dots Per Character
- Proportional .... 10 to 20
- Condensed, Compressed or Standard 12

Vertical Spacing .... 12, 6, 8 lines per inch (Computer selectable) 1/12, 1/36, 11/108-directional feed available when 12 or 6 lines per inch is selected.

Dots Per Line
- Correspondence Quality 10 CPI 2640
- Elongated Correspondence Quality 5 CPI 2640
- Proportional 2640
- Elongated Proportional 2640
- Condensed 16.7 CPI 2640
- Elongated Condensed 8.3 CPI 2640
- Standard 10 CPI 1584
- Elongated Standard 5 CPI 1584
- Compressed 12 CPI 1900
- Elongated Compressed 6 CPI 1900

Character Set
- Proportional or Correspondence Quality .... ASCII 94 or modified ASCII 94, European symbol 32
- Condensed, or Elite Standard .... ASCII 94 or modified ASCII 94, European Symbol 25 or Japanese Kana 64, and Block Graphic 30
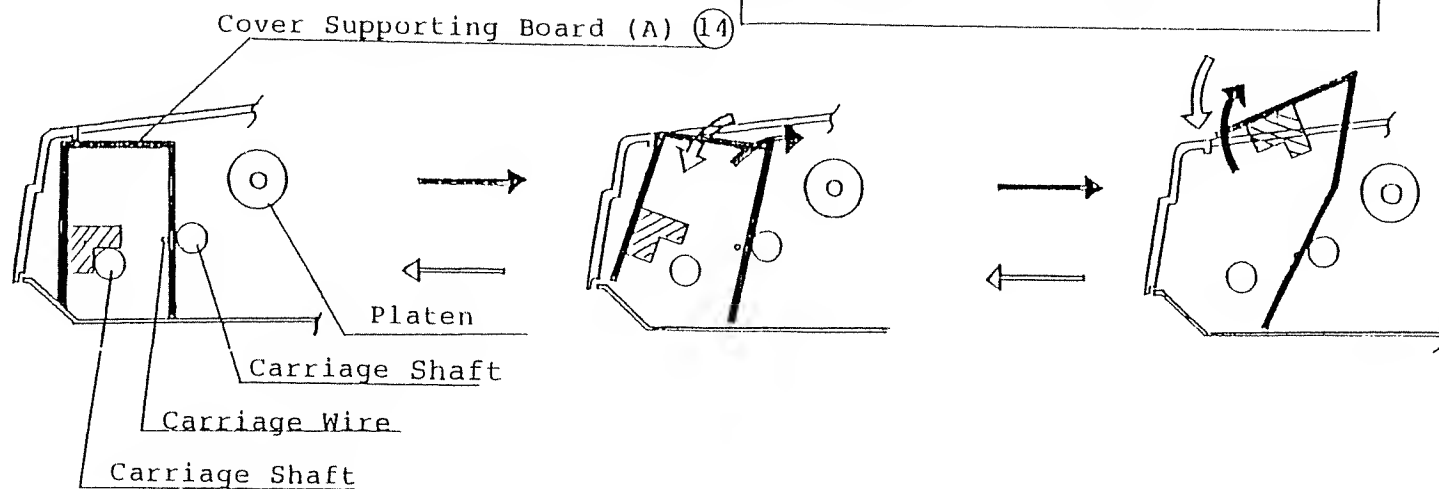
Interface
- Parallel .... 8-bit Data and 4-bit Status
- Serial .... 8-bit Unit 600 or 1200 BPS selectable

Print Head Life . . . . 2000 hours typical
Preventive Maintenance . . . . Normally every 6 months

Temperature and Humidity Range
    Operating . . . . 41°F (5°C) to 104°F (40°C), 40 to 80!
    Storage . . . . -40°F (-40°C) to 160°F (71°C), 20 to 90!

Paper
    Fanfold Paper . . . . Continuous business paper (4-15" wide)
        with feed holes
    Copy Paper . . . . 1 original + 2 copies
        (34 kg (11 lbs) non-carbon paper)
    Single-sheet Paper . . . . 40 ~ 60 (14 ~ 20 lbs) kg good quality
        paper

Ribbon . . . . Radio Shack Catalog Number 26-1418
Size . . . . 25.6" x 6.3" x 13.3"
        25.6" x 6.5" x 13.6"
        65.0cm x 16.5cm x 34.5mm
Weight . . . . 35 lbs (16 kg) maximum
Power Requirement . . . . 120V AC, 60 Hz, (for USA/Canada),
        or 220V/240V AC, 50 Hz (for European
        and Australian models). 85W maximum.

Memo

CAUTION !!

Be careful to remove/replace of the Cover Supporting Board (A).
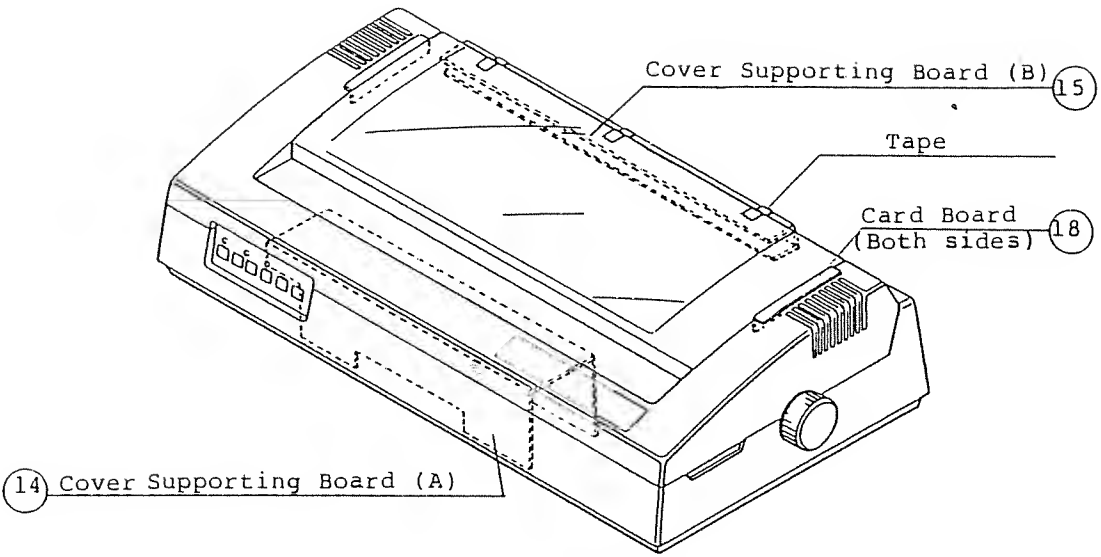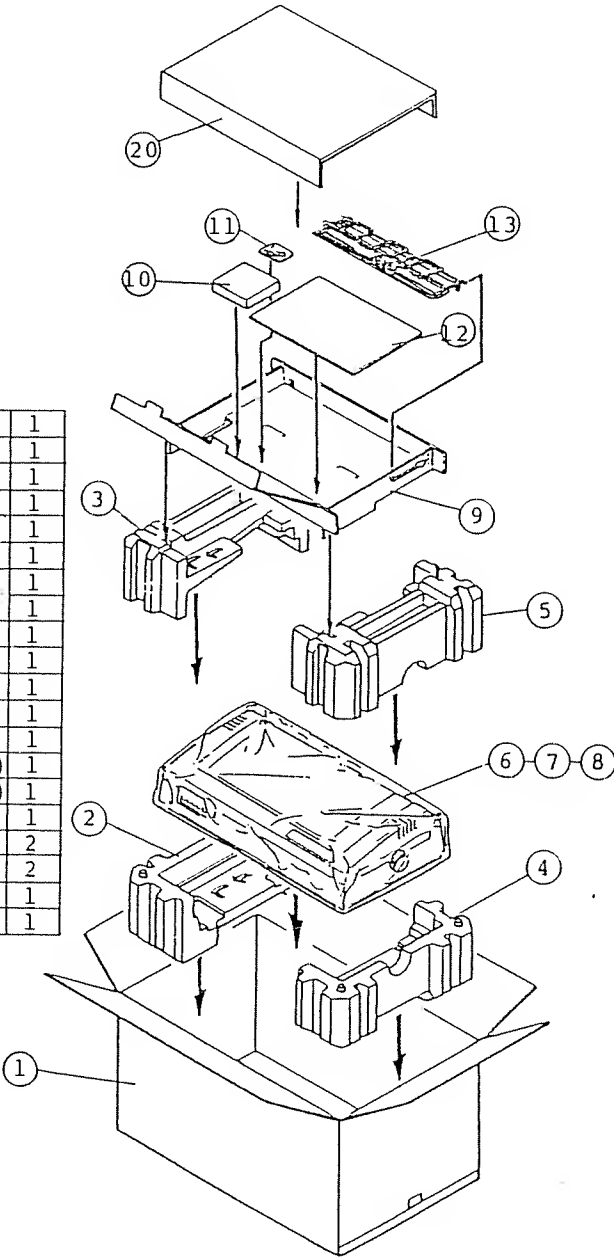
Methods are as following figures.

NOTE:
Remove Tie Clip before power Switch ON.

Tie Clip

Cover Supporting Board (A) (14)

Platen

Carriage Shaft

Carriage Wire

Carriage Shaft

Cover Supporting Board (A) (14)

Remove ——

Replace ——
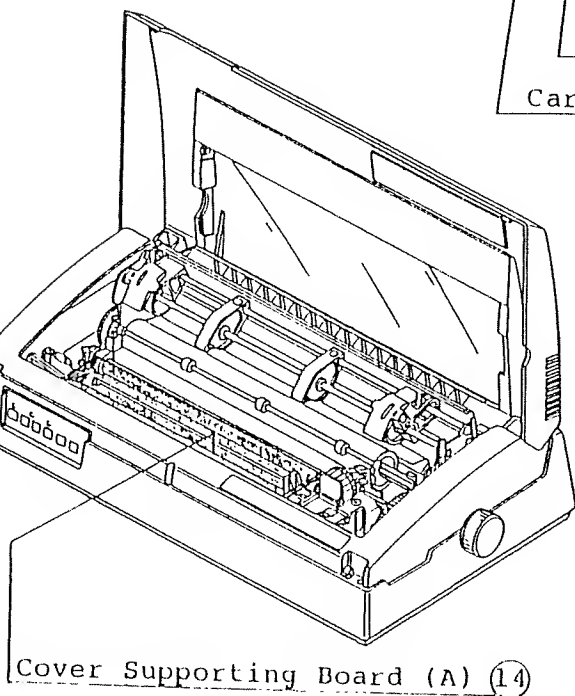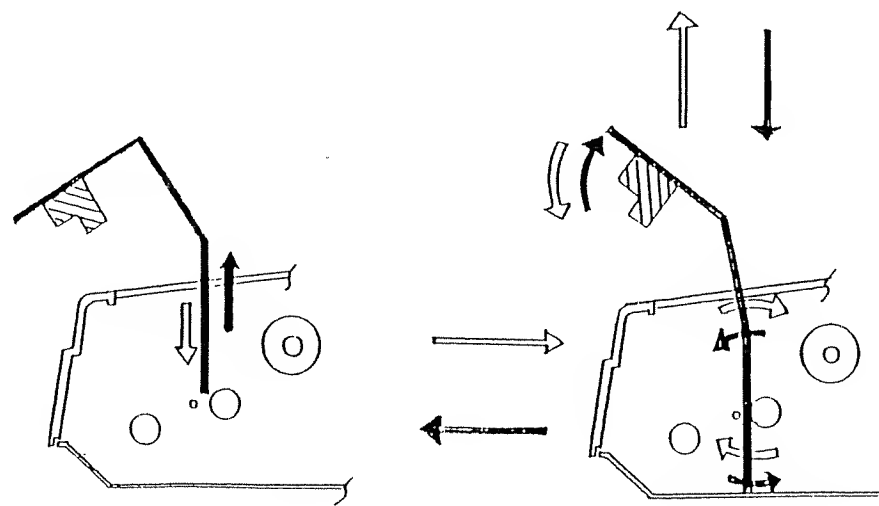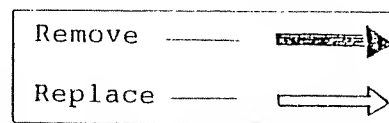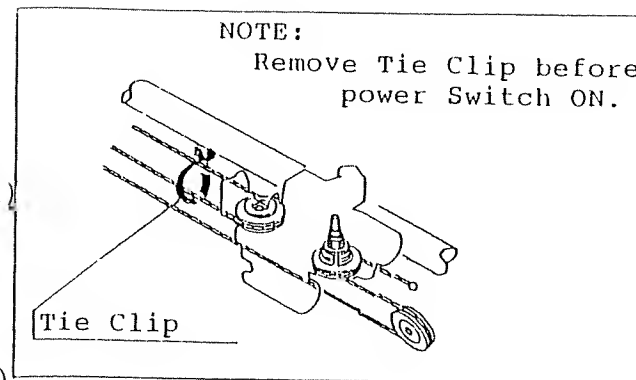
DOT MATRIX PRINTER
DMP—420

UNPACKING / REPACKING INSTRUCTIONS

NOTE: FAILURE TO ADHERE TO THE FOLLOWING INSTRUCTIONS COULD

RESULT IN VOIDING THE WARRANTY.

Cover Supporting Board (B) ⑮

Tape

Card Board (Both sides) ⑱

⑭ Cover Supporting Board (A)

PARTS

1	Shipping Carton	1
2	Lower Cushion (A)	1
3	Upper Cushion (A)	1
4	Lower Cushion (B)	1
5	Upper Cushion (B)	1
6	Packing Cover (A)	1
7	Packing Cover (B)	1
8	DMP-420 Printer	1
9	Attachable Case	1
10	Ribbon Cartridge	1
11	Fuse	1
12	Owner's Manual	1
13	Paper Guide	1
14	Cover Supporting Board (A)	1
15	Cover Supporting Board (B)	1
16	Grip Band	1
17	Band	2
18	Cardboard,Cover	2
19	Platen Protected Paper	1
20	Cardboard,Upper	1

Both sides ⑰

Platen Protected Paper ⑨

⑭

⑯ Right side
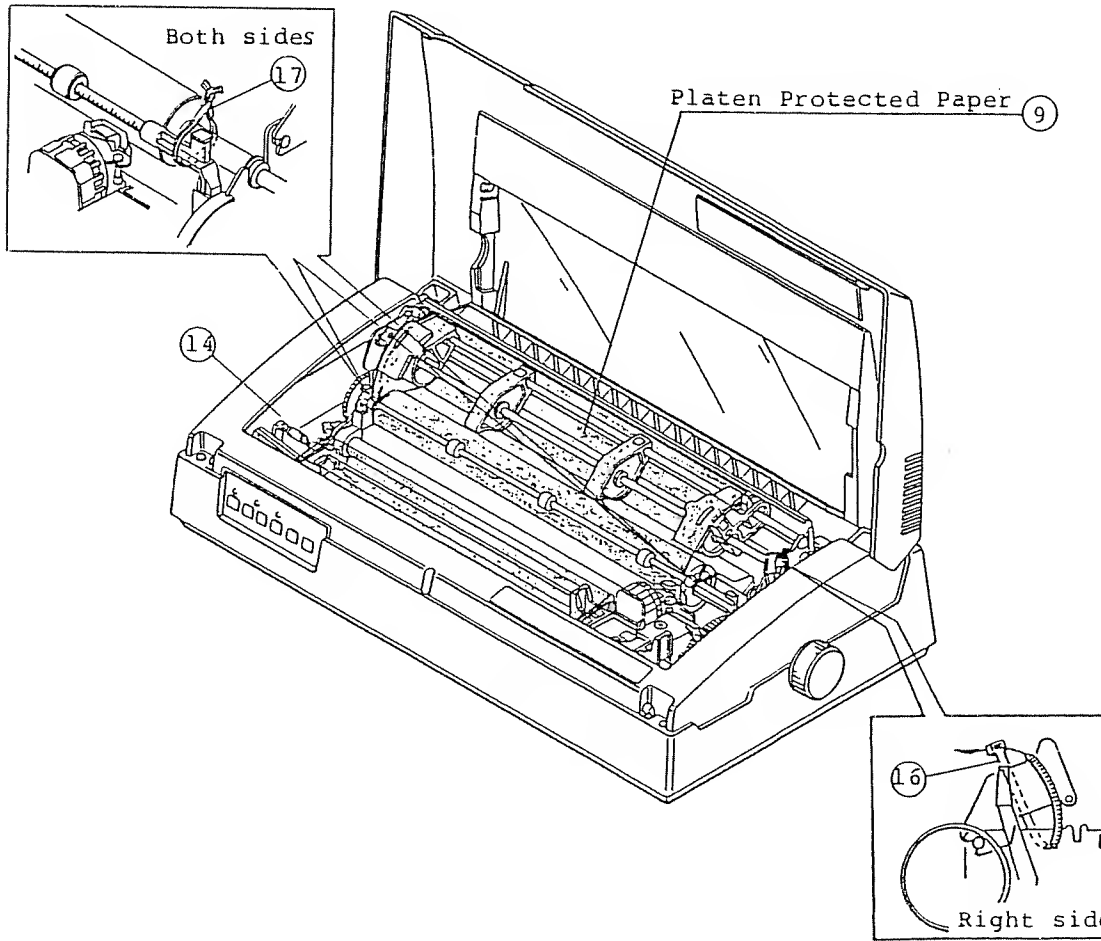
Radio Shack®

Save the packing materials for repacking.

RADIO SHACK, A DIVISION OF TANDY CORPORATION

U.S.A.: FORT WORTH, TEXAS 76102
CANADA: BARRIE, ONTARIO L4M 4W5

TANDY CORPORATION

AUSTRALIA	BELGIUM	◄ U. K.
91 KURRAJONG AVENUE NOUNT DRUITT; N.S.W. 2770	PARC INDUSTRIEL DE NANINNE 5140 NANINNE	BILSTON ROAD WEDNESBURY WEST MIDLANDS WS10 7JN

6 A 3